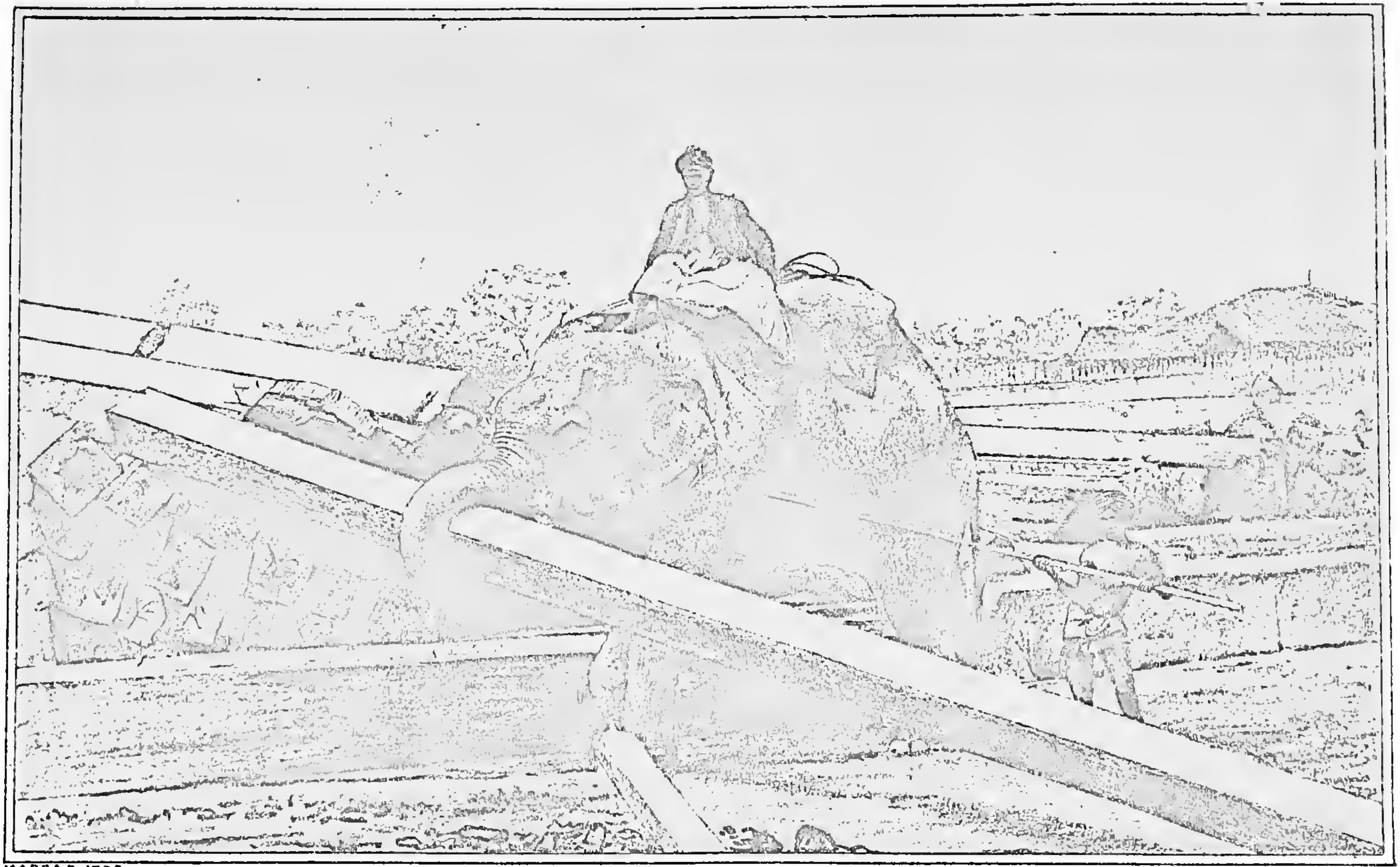

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PLATE, I. BURMESE ELEPHANT· MOVING BEAMS.

(FROM A PHOTOGRAPH)

[*Partly reprinted from the* QUARTERLY JOURNAL OF VETERINARY SCIENCE IN INDIA].

A MANUAL

OF THE

DISEASES OF THE ELEPHANT

AND OF HIS MANAGEMENT AND USES.

BY

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(ILLUSTRATED.)

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TO

CHARLES STEEL, F.R.C.V.S.,

(INSPECTING VETERINARY SURGEON, BOMBAY ARMY.)

THIS LITTLE WORK

IS

AFFECTIONATELY DEDICATED

BY

HIS SON,

THE AUTHOR.

PREFACE.

The small amount of knowledge possessed by us concerning the Diseases of the Elephant is thus far advantageous that it enables us for the present to deal with their cure in language familiar to non-professional readers and at the same time make our remarks suggestive also to those who have been scientifically educated to the treatment of diseases of animals in general.

Few veterinarians pay attention to the branch of their science with which we are about to deal and even those who do are rarely placed in professional charge of elephants, facts which react on one another and retard the advance of this division of pathology. Such observations as have been made are mostly due to Transport and other Military and Civil Officers in whose way chance has thrown the charge of elephants among multifarious duties of a very different nature.

It is extremely creditable to such officers as Drs. Gilchrist and Slymm and Lieut. Ouchterlony that, under such discouraging circumstances, they have done so much as they have "on the spur of the moment" as it were.

Although we know very little about elephant diseases and still less about the action of remedies on this huge quadruped, the labours of various authors have resulted in a considerable amount of information about the management of the elephant and his relations to Army Transport. Our object is to summarize and digest such material as is to hand and adapt it to the use of Transport and Veterinary Officers and to others interested in Elephant Management.

BANGALORE, 1885. JOHN HENRY STEEL.

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INTRODUCTION.

PART I.

THE NATURAL HISTORY OF THE ELEPHANT.

In a practical study, such as this is, we need not enter into questions of the origin of the various extant genera of Elephas nor their relations to the large extinct quadrupeds, mammoth and mastodon. We need not even dilate on the use of Elephants as animals of war by the Carthaginians, Romans, Persians, and other great nations of the Past nor their use in grand triumphal processions and in combats of the Arena. We at once proceed to their value in the present day, when we find that as an animal of war the Elephant is utilized only in the South of Asia, and even there his use is becoming much restricted. The enormous weight of the elephant, which renders him difficult to transport by boat or rail, and the expense of keep and original cost, as also his liability to disorder and the amount of care necessitated in his use, have considerably restricted the employment of the Elephant for military purposes among civilized races. His terror of fire arms renders his huge bulk and great strength terrible rather to friends than foes and in the Burmese wars formidable lines of elephants have been put to rout by small bodies of Cavalry. Even in Siam and Burma he is becoming in Government service mainly an animal of State. However there are parts of our Indian Empire in which he can still be rendered extremely useful to an Army for Transport and other purposes; thus he will carry tents and other *impedimenta*, also mortars and cannon of various kinds, will often serve to free a gun or wagon fixed in the mud by pressing his enormous weight against it and will prove useful in bringing heavy building materials for fortifications, bridges, and so on, also in moving heavy siege train guns. In a jungle country too, he may be used as a pioneer and road maker. He will, therefore, for a long time continue to be one of our Army Animals in spite of his not "standing fire," nor being useful in the exigencies of modern battle. Though no longer retaining his former proud position in the foremost line of the fight, but ignominiously replaced by bullocks before he reaches the line of fire, he still appears in gorgeous pageants of State and proves useful in various ways to the sportsman.

Sanderson discusses the question of *transport of elephants by rail.* He preludes his remarks by saying "at the present day, when railways and good roads have modified the requirements of military transport, elephants are not so necessary with troops as formerly. They will of course always be required for the carriage of frontier Regiments in Assam and Burma, as the conditions of those countries will always .preclude the use of any other means of Transport." He then shows that carrying Elephants by rail would render them useful in adaptation to Army Transport and also to enable their being stationed where keep is cheap; they at most stations cost Rs. 1 per diem, for fodder only, and cannot conveniently be marched more than 300 miles per month. Elephants have been successfully carried by rail secured in open cattle trucks fitted with cross beams on each side of and before and behind the animal to steady it: 40 wagons could in 10 days be fitted to carry elephants with their clothing, gear, and some fodder; 32 elephants can be carried in one train, within the regular goods train weight of 400 tons, and they would not make the trucks top heavy; the fore and hind feet should be shackled together in pairs and the shackles passed through ringbolts in the floor between each pair of feet. Fodder can be provided for the animals in their trucks and water given morning and evening; there need be no difficulty in getting them into the trucks with proper arrangements. The four beams forming the fittings for cattle wagons when used to convey elephants might be kept in readiness at the railway stores. In this way elephants might be as expeditiously concentrated at any point as troops. Thus we see, from the statements of the leading authority of the day on the subject of Elephants, that some of the objections raised against their use for military purposes are purely theoretical and that they can be conveyed economically and with facility by rail; elephants, also, are often carried by boat.

In Burma wood stacking is very largely done by elephants, and the precision and accuracy with which they move and adjust enormous beams is an object of admiration to the observer. They sometimes carry beams accurately balanced on the Tusks.

Recent warlike operations by the British in the East have been associated with the use of the elephant. In Abyssinia and Afghanistan he has done his work well. We see him in India en-

gaged in drawing heavy field guns, carrying fodder and baggage, penetrating jungle in tiger hunting, and conveying magnates in religious and state processions.

Para. 1706(*a*) of the Commissariat Code, 1882, states that in Bengal occasionally elephants may be lent to officers for shooting excursions on payment of all expense incurred in excess of the ordinary keep. In Bombay also such animals may be obtained "to be ridden or used as beaters and *not as baggage animals*" and the actual cost of keep together with the pay of attendants must be defrayed by the hirer. In either Presidency no animal is to be lent except he be in fit condition and he is to be accompanied by instructions in writing as to the food and care he will require, which instructions must be carried out. In the event of the animal becoming injured the borrower must show that every necessary care has been paid to him or be liable for the full value of the beast, which in Bengal is put at Rs. 1,400.

Authority is given in the Code (Para. 1714 and 1846) for a special Howdah-Khana or Shootur-Khana Equipment to be kept up by the Commissariat for the use of the Viceroy and Commander-in-Chief. Also in Bengal, when ambulance carts are not available, elephants may be lent by the Commissariat, fitted with Charjamahs (foot boards and ropes), for the purpose of taking hospital patients out for an airing.

In the Native States of India elephants still retain much of their importance. Thus at the grand annual mustering of the feudatories of the Nizam of Hyderabad large numbers march past in the Lungur procession covered with gorgeous trappings and painted in vivid colours interspersed with gilding. These animals gravely salaam with their trunks to the Nizam and his ministers and guests. At other times they may be seen picketed in open lines, and those which belong to His Highness are lent to British officers for shooting in the jungle or for journeys to see "the City." Thus to some extent the fact that in the Madras Presidency Government elephant may not be used for private purposes is atoned to officers by the liberality of our Royal Allies. Such Native States as Baroda and Indore are also remarkable for their show of elephants—the former especially, since under the late Guicowar were to be seen on festive occasions horrible exhibitions of cruelty in the form of elephant baiting and combats.

The VARIETIES OF THE ELEPHANT are much more nnmerons than has been imagined. Zoologists speak of *Loxodon,* the African elephant, recognizable by his large ears, lozenge shaped-enamel markings on the grinding surface of the teeth, convex forehead and few hoofs (generally 4 in fore and 3 in hind foot), also small tusks of the female. The range of this form has been gradually curtailed by the advance of civilization from the Cape of Good Hope, but East African explorers and Ivory hunters meet with them in numbers increasing towards the interior of the "Dark Continent." The verdict of a recent writer (Ouchterlony) that "African elephants are all head and no barrel and lack the intelligence and tractability of the Indian" is hardly borne ont by the history of the Carthaginians under whom the African elephant rendered most important and willing services—however the fierce tide of Moslem invasion seems to have proved prejudicial to the civilization of the elephant in Africa, and at the present day he is slaughtered recklessly for the sake of his ivory tusks but is left to roam free in his native wilds undisturbed by the trainer and Mahout. Doubtless the reckless profusion displayed in his destruction requires attention and some efforts should be made for his re-domestication. *Euelephas,* the Indian genus, on the other hand, is an animal which has been domesticated continuously in the historic period and has undergone a great deal of variation. We have the authority of Sanderson for saying that there is no evidence of decrease in number of elephants in India, but certainly they are much less numerous in Ceylon than formerly. Sir Stamford Raffles and Sir Emerson Tennent are the principal authorities on the *Ceylon Elephant* which is much less frequently tusked than that of India. Elephants have been exported from Ceylon since the time of the first Punio War. They were the perquisite of the Kandyan Crown. The Portuguese and Dutoh Governments successively kept up elephant-hunting establishments in Ceylon, and now there is a large export trade, mainly from Manaar, horses being received in exchange (Tennent). All the varieties of Euelephas agree in the concavity of the forehead, smallness of the ears, and the parallel arrangement of the enamel layers of the molars, generally the toe nails are five before and four behind, but subject to considerable range of variety in number. *Shan* elephants are tall, massive and handsome, gene-

ally tuskers; *Burmese* have been described as smaller and somewhat weedy mucknas, but, according to Capt. Hood, the Burmese elephants are shorter, stouter, and more compact than those of Hindustan being superior for hill work, carrying loads over steep places and across swamp boggy ground and they are excellent for draught purposes. The *Chittagong* are good all round and make the best koonkies; the *Assamese* are large, both tall and massive, and excellent for hunting purposes (*Field*).

With regard to the *Sumatran variety,* Prince Lucien Bonaparte,* summarizes Temminck's conclusions as follows:—"This species is perfectly intermediate between the Indian and African, especially in the shape of the skull, and will certainly put an end to the distinction between *Elephas* and *Loxodon,* with those who admit that anatomical genus; since although the crowns of the teeth of *E. Sumatranus* are more like the Asiatic animal, still the less numerous undulated ribbons of enamel are nearly quite as wide as those forming the lozenges of the African. The number of pairs of false ribs (which alone vary, the true ones being always six) is fourteen, one less than in the *Africanus,* one more than in the *Indicus*; and so it is with the dorsal vertebræ, which are 20 in the *sumatranus* (*21* and *19* in the others), whilst the new species agrees with *Africanus* in the number of sacral vertebræ (*4*) and with *Indicus* in that of caudal ones, which are *thirty-four.*" Schlegel confirms the identity of the Ceylon elephant with that of Sumatra and shows that "the Indian species is more robust and powerful; the proboscis longer and more slender; and the extremity (a point in which the elephant of Sumatra resembles that of Africa) is more flattened and provided with coarser and longer hair than that of India."

Sanderson in 1882, enumerated the Government elephants as follows:—Commissariat, Bengal and North India, 1,016; Bombay, 78; Madras and Burma, 213; Forest, Frontier, Police, Railway, Telegraph, and Public Works Department in India and Burma, 300; Grand Total, 1,607 (and a few males kept for State purposes).

The Government hunting establishment (Keddah) at Dacca is the only one at present working in India, Mr. Sanderson being

* Pro. Zool. Soc. Lond., 1849, p. 144; note.

its Superintendent. The total revenue from the elephant mahals in Assam amounted in 1881 to Rs. 63,108, *i.e.*, a large clear gain to Government. Only females are in future to be purchased for the public service (Commissariat Code, para. 1768)—the necessary numbers can readily be obtained from Dacca although many are lost by death and incapacitation through injuries in capture and training, also defective preliminary domestication. A recent Army Commission has recommended that the Keddah establishment be abolished and such Commissariat elephants as are required be the Government share of captures made by native hunters. At present the restrictions on private capture render the prices exorbitant.

In *Nepaul* there is a breed of elephant of dwarf size and adapted for life among the mountains. In the *Malay Peninsula* (see Oriental Sporting Magazine, (New Series), Vol. I., 1868) there seem to be two varieties, those north of the hilly districts of Queda resemble the Mirgabund, or very light built Indian elephant, those south of Queda (including Cambodia, Cochin China, Borneo, and Sumatra) are much heavier in build, more majestic, carry their heads higher, and slope more from the top of the spine to the tail root—the forehead, too, is much more prominent. It has been observed that, whereas "tuskers" are rare in Ceylon, in India and South of Queda (in Malaya) they are the rule. Mucknas or Hives, on the other hand, are frequent (and always have tusks) in South Malaya but are rare in India.

The Dacca captures show:—

Males : females :: 43 : 100
Male tuskers : Mucknas :: 10 : 1

F. T. P., writing to the "*Field*," says MUCKNAS, are exactly like Ceylon elephants and have 20 pairs of ribs. They are tuskless or have imperfect tusks pointing downwards, are of larger size and have long melancholy looking heads, narrow foreheads, and great depressions between the frontals above the eyes and the temple; trunk large and massive; eye sleepy: countenance morose and are excellent workers. Some elephants (Gunéshes) are born with only one tusk—if this be the right hand one they are reverenced by the Hindoos.

Much has been said about the "WHITE ELEPHANT," which receives royal and divine honours in Burma—its very name has

become a synonym for something expensive, useless, and extraordinary; yet we are assured that there is "no such thing as a white elephant." It is certain that the animals which have been exhibited under this designation in Europe have only been rendered white by more or less skilful artificial processes. Archibald Forbes, in his "*Glimpses through the cannon smoke*," describes a visit to the royal animal at Mandalay. "His Lordship, in so far as his literal claim to be styled a white elephant, is an impostor of the deepest dye, and a very grim and ugly impostor to boot. He is a great, lean, brown, flat-sided brute, his ears, forehead, and trunk are mottled with a dingy cream colour. It is not the whiteness that is the criterion of a white elephant, which may be a brown elephant actually in colour. The points are the mottling of the face, the shape and colour of the eyes, the position of the eyes, and the length of the tail. He has a peculiar and abnormal eye. The iris is yellow, with a reddish outer annulus and a small, clear, black pupil, it is essentially a shifty treacherous eye and I noticed that everybody took particularly good care to keep out of range of his lordship's trunk and tusks. The latter are superb, long, massive, and smooth, their tips quite meeting far in front of his trunk. His tail is much longer than in the Indian elephants and is tipped with a bunch of long, straight, black hair. The so-called white elephants are sports of nature and of no special breed. They are called Albinoes, and are more plentiful in the Siam region than in Burma." A Siamese work tells us that *Xang Phuck* is the Siamese name for a genuine white elephant, *Xang Pralat* is wonderful but not otherwise eminent. The following are the points looked for in a genuine white elephant—*Skin* must have a reddish colour; *eye* with reddish outer annulus; *teeth* to have a peculiar formation, and *tail* to be unmutilated; *toenails* pure black and (says a Burmese work) five in number on the hind feet. The animal must turn red when water is poured over him, and must be a male to receive honors. As a rule the white elephant is not healthy; his legs are usually swollen at the joints and often covered with tumours; his sides lean and hollow, and his hide dry and furrowed. The Siamese consider that elephants which affect a fish diet are very truculent and dangerous. They also say that *Hinxat* is the one which wanders about the sea coast and eats crabs, he will attack man at sight; *Bek* eats so much fish that his hide becomes scaly.

There has been much discussion as to the position of the elephant in relation to other vertebrated animals. To show that this question is by no means a simple one we may quote the following extract from a Lecture on the Elephant as published in 1881.*

The Comparative Anatomist gazes with wonder and delight on the elephant: its structure may be thought to result from a union of the *disjecta membra* of animals most diverse and far separated from each other in the zoological series, so that it is bird-like in the absence of pleuræ and the abdominal position of the testes; whale-like in the arrangement of many of the bones of the face; and approaches even man in the form of the pelvis and the shortness of the cervical vertebræ. It is well worth our while to draw up a list of the principal features of structure which this animal shares with others:—

The *teeth* in their general characters remind us of those of rodents; but for a parallel to the enormous defensive anterior teeth we can refer only to those of ziphius (the sword whale), and the continued production of fresh molars at the posterior part of the series, as the jaw elongates, reminds us also of the toothed whales, and even of animals lower considerably in the scale of vertebrates. Like the molars of the horse, these teeth have much *crusta petrosa,* but in the elephant this binds the teeth together. In accordance with the state of the teeth the *temporo-maxillary joint* is somewhat like that of rodents, whereas the stomach and intestines remind us strongly of these organs as seen in the rat and horse. While the face is like that of the horse and rat in some respects, it also resembles that of the whale and the tapir. As in the latter animal, there is a remarkable development of the upper lip and nostrils, known as the trunk; as in the whales, the malar arch is very slight, the nasal passage in the skull vertical, short, with rudimentary turbinated bones, and the nasals are very small the premaxillæ very long and important, and, in association with these characters, the cervical region very short. In this latter respect, as also in the inferior maxillæ being pointed anteriorly, and the molars extended posteriorly within the ramus, and the skin being thick, it resembles our familiar friend, *sus domesticus.* The thorax consists of a large number of vertebræ, ribs, and sternal elements, reminding us of that of the horse; but it is conical in shape, like that of rodents

* (Veterinary Journal, 1881, Vol. I, p. 17.)

and carnivora and other animals which move the fore-limbs with freedom for purposes other than progression. And yet the form of the brain (like that of the horse), and the almost complete absence of clavicle, the rudimentary state of the coracoid, and enormous scapula, with the "hoof-slippers" (like those of the camel) leave no doubt as to its being an ungulate. Yet this same scapula, and with it the leg and thigh bones, are strangely wanting in finish, are *generalized,* as we anatomists term it; and so also must be set down as general characters the conical form of the chest, with its large number of bones, the man-like pelvis, and the pentadactyl fore-foot (*manus*), together with some indications of what we should term, had they occurred in the horse, imperfections of development, or infantile characters, such as the tendency to division of the apex of the heart (as seen also in dolphins), the persistence of the Eustachian valve, the kidneys lobulated like those of the ox and bear, and the short condition of the sacrum, which consists of only a few vertebræ Other special features are the enormous facial sinuses in the adult, like those of the ox and owl, the spine of the scapula like that of a rat, and the semi-plantigrade progression. The excretory apparatus of the liver resembles that of the horse, but also, like that of the giraffe, has a dilatation against the duodenum. The uterus somewhat resembles that of the mare, but the placenta is zonary, as in carnivora; the external generative opening of the female is remarkably far forward, and the mammæ are pectoral like those of the woman and the bat. The radius very remarkably crosses the anterior surface of the enormous ulna. Add to this that the elephant resembles the extinct monsters of old in hugeness of his bulk, and we may well ask ourselves how we shall, through this almost endless complication and mixture of characters, trace such an animal in its relations to the other mammalian inhabitants of the globe.

We have seen that there can be no doubt as to the ungulate characters, though they are intermingled with the generalised. And so we learn that the elephant, "as one born out of due time," is a near relative of those generalised pentadactyl ungulates, which were the progenitors, in ages long past, of the hoofed animals of the present day. The elephant is an anachronism, but a noble one, which has happily been preserved for our use in the present day by some of the wonderful features of structure which

we have just noticed. Without his huge weight, his upright limbs, short strong neck, and large weighty skull, hollowed out by sinuses, he could not have rambled through the dense jungle which protects him; without his huge plantigrade feet, his tusks, and the irregular facial sinuses by which the brain is concealed, he would long ago have succumbed to carnivorous foes and to man. His beautiful organ of touch and prehension has atoned for the shortness of his neck, and obtains for him grass, or branches from trees to a level with which his stature brings him above most other mammalian denizens of the jungle. The nature of his food accounts for the similarities between his alimentary canal and that of the horse and some other herbivora, and that of the rat. Even branches of considerable size crushed between his enormous grinders assist to feed him, for, like rodents, he can obtain nourishment from wood, which, however, generally conduces simply to due repletion of his digestive organs. But why the cetacean characters of the skull? They result from atrophy of the nasal chambers, and can hardly be thought true affinitive indications. This imperfect development of nasal passages accords well with the absence of pleural sac, and the extreme smallness of the nostrils and the length of the nasal passages. Doubtless throughout these passages the odoriferous particles make due impression on the mucous membrane, as the air is slowly drawn in by expansion of the long generalised pleuraless thorax, sufficiently to fulfil the respiratory needs of the animal, which are not great, for the circulatory apparatus is small and infantile, the pulse slow, and the red corpuscles below the mammalian average size. The life changes of the animal, also, are not rapid; excretion is slowly performed by his poorly developed respiratory and renal organs and not excessively large liver nor very active skin, and so we can well understand why, in nature, the elephant, like other slow living animals, attains a great age. Anatomy often leads us to surmise what is confirmed by other lines of observation! Finally, the thickness of the skin protects the other organs from sharp stakes and other bodies likely to injure during passage through the jungle, the attacks of leeches and other external parasites, such as might readily be obtained in marshy parts of the jungle, and in the ponds and nullahs in which the elephant delighteth to gambol. Also, with

the well-developed panniculus carnosus like that of the horse, it protects from the teeth of mammalian foes, and from insect enemies, so that the gadfly has to content herself with the tusks on which to deposit her eggs. The owner of the tame elephant will regret this large development of panniculus, when he finds his fully loaded or *overladen* animal at once free himself from encumbrances by making energetic use of the cutaneous muscle.

Thus, though the elephant is rodent-like, whale-like, man-like, and owl-like, it is so only in adaptation to its conditions of life; to the same causes may be attributed its special resemblances to the horse, ox, pig, and tapir. *In the main it stands isolated as a generalised ungulate, the closest relatives of which have long ago succumbed to the greater energy and higher specialization of the hoofed animals, which we find so well adapted to the present state of our earth.*

We must now hastily summarise some facts with regard to the HABITS OF WILD ELEPHANTS which have an important bearing upon the questions of his management after domestication both in health and under disease. Writers on sport and travel from very early times give us pleasing details of the qualities of elephants, most of them good and such as facilitate domestication. The social habit which leads them to go about in herds, fondness for the offspring, courage in facing carnivorous animals, and inoffensiveness are admitted to them by all observers, but Sanderson informs us that the sagacity of the elephant has been much over-rated, that whereas he is very cultivable and obedient he is decidedly wanting in originality. Though his vices are few; and in obedience, gentleness, and patience he surpasses all other domesticated animals; still he is "decidedly stupid." Hard as this verdict may seem to us and contrary to what we have been led to believe few will find themselves in a position to dispute it. Whether it be from stupidity or from contempt of the devices of such a petty creature as man, or whether, as Tennent says, his terror and inexperience render size and sagacity of no avail against the devices of hunters, the lordly beast is captured very frequently, and by various methods thus classified by Sanderson.

I. *Capture of single elephants :*—(1) By pitfall, the old native method now prohibited as wasteful and brutal. (2) By running down and noosing by the aid of tame elephants. In this process

the wear and tear of tame animals is great and they are goaded unmercifully by blows with a spiked mallet. (3) By handnoosing; men on foot securing the hind legs; this is practised in Ceylon.

II. *Capture of herds of elephants.*—(4) By enclosing in a salt lick or in a pool in the jungle, this is reckless waste. (5) (*Government plan*) By surrounding a herd, wherever found, with a circle of men and building a stockade (Korahl or Keddah) into which the herd is driven.

III. *Large solitary elephants are captured* by means of trained females, but these, though called so, are not true "decoys" but entirely at the command of their riders.

These solitary elephants, termed "*Goondahs*" or "*Rogues,*" are most sought after by the hunters, they being the males expelled from the herd by some more powerful animal and therefore the more disposed to yield to the blandishments of females, though morose in the extreme and dangerous to approach. Sir S. Raffles speaking of Ceylon says "the natives fancy that there are two kinds of elephants—the *Gaja berkampong,* those which always go in herds and which are seldom mischievous, and the *Gaga salunggal,* or single elephants, which are much larger and ferocious, going about either singly or only two or three in a company." Johnstone, in his "*Notes on Elephants*" read before the Asiatic Society, says herds average 20—25; in Ceylon 6—12; in Sumatra and Borneo, 12—18; in the Nepaul terai, Nilgiris, and Southern Ghauts, 25 to 35; in Malayala, Cochin-China, and Cambodia, 40—50; one herd seen in Siam must have numbered 500 at least. Herds of elephants (which are *families,* their members presenting family traits) vary much in size, sometimes consisting of even 100 individuals but generally more or less broken up. They make their way through otherwise trackless forests—preceded by a *female,* generally the largest, and following mostly in Indian file. When fleeing from danger the female assiduously keeps the young *in front of her.* Herds which have been broken up re-collect, and if one herd has been disturbed even others will leave the place (Young Shikarry). The conformation and great weight of the animal specially adapt him for thus making a track through the jungle. The Bull rambles much more than the cows, but he always keeps the herd within reach, and will often nobly cover the retreat of his cows. After elephants have been disturbed

in a district they are apt to desert it often even for years. However they are not readily driven from a good feeding ground—they especially enjoy young sugar cane and completely devastate the crops of natives, for whose spears and arrows they care but little. It has been observed that the Malayan elephant wanders over a great tract of country, annually seeking the sea for its salt licks in hot weather and the mountains in the rainy season, spending a few hours in each paddy field on the route; sometimes solitary elephants, "Rogues," remain where they find good quarters and become the terror and scourge of the district (Young Shikarry). The rifle drives them 30 or 40 miles off, and if 3 or 4 dead elephants lie about fresh herds fight shy of the place.

Although all elephants become shy on the approach of man, it has been found that the races differ much in tractability, those of Northern India are timid, but those of Southern India are savage and plucky in attack. The track of the Bull's fore foot is larger and rounder than that of the cow; females are preferred for capture both because they are the more tractable and also because they are not liable to run musth (*vide infra*). Since females only are used in the public service, the males captured are sold by the Keddahs to native princes by whom they are preferred as being larger, prouder, and more imposing than females.

Male elephants in Southern India sometimes attain 9 feet 10 inches in height (7½—8 feet being the medium). Twice round the fore foot gives the shoulder height to within a few inches: taken at the shoulder, the females seldom exceed 8 feet. The East India Company fixed their standard at 7 feet and upwards in height taken at the shoulder, and the New Commissariat Code adopts the same standard "to be taken as with a horse." The *native method of measuring* is by throwing a rope over them until it touches the ground on either side. Half the total length of the rope from ground to ground is taken as the height, a manifest inaccuracy which accounts for apparently exaggerated statements as to gigantic elephants (*vide* Indian Sporting Review, October 1857). Very much misconception exists with regard to the size of elephants, which has been much exaggerated by authors of works on travels and fiction. The elephant calf at birth is about 3 feet at the shoulder and weighs 200 lbs. A large mature elephant weighs 6,000—7,000 lbs. (3—3½ tons); Sir Garnet Wol-

seley says "72 cwt., of which 4/10 is borne on the hind feet, which are 6½ feet from the fore legs." The full growth is attained at 20—25 years of age, which may be considered the age of puberty. Then the sexual passion of the male manifests itself and he is driven from the herd to live a solitary life until, at 35, he attains maturity and adult strength to enable him to assume command of a herd. Maturity is earlier in the female, the first calf being born when the cow is 13 to 16 years of age, generally during the rains in September to November. The young animal is capable of moving with the herd in a day or two after birth and lives on the mother's milk for some five or six months; one observer states that "many elephants suck for 10 or 12 years," which savours somewhat of exaggeration! Tender grass and delicate herbage is the earliest solid food of the calf and he rapidly thrives on it. Although the cow is said to evince "no special attachment for the offspring" it is certain that she protects the little one in various ways carrying it over rivers with her trunk or on her shoulder and protecting it from injury with great zeal and bravery. Also in spite of her notorious dislike for small animals, especially dogs and fowls, she fondles the calf with her trunk and facilitates its obtaining its natural food.

When, in due course of time, the youngster becomes a recognized member of the herd he shares with it the free life in the jungle. The elephant (like most other pachyderms) loves water, will draw it into his trunk and blow it over his body surface, rolls in the stream or tank, and gambols freely, giving free way to the sportive tendencies of his nature, or quietly lies broadside enjoying the cool moisture. Although essentially a tropical animal he stands exposure to considerable heat badly: he constantly endeavours to cover the upper part of the head and more exposed parts of his body with leaves, branches, and mud, also, we are told by one author that the elephant is enabled to draw from his throat by means of his trunk, a copious supply of saliva (probably fluid accumulated in the pharyngal pouch) which it squirts with great force very frequently all over its skin, and that "it grubs up dust and blows it over its back and sides to keep off the flies, and may often be seen fanning itself with a large bough." Dr. Cobbold, in commenting on the paucity of Ectozoa of the elephant attributes it to the "rough time" they would have in consequence of this

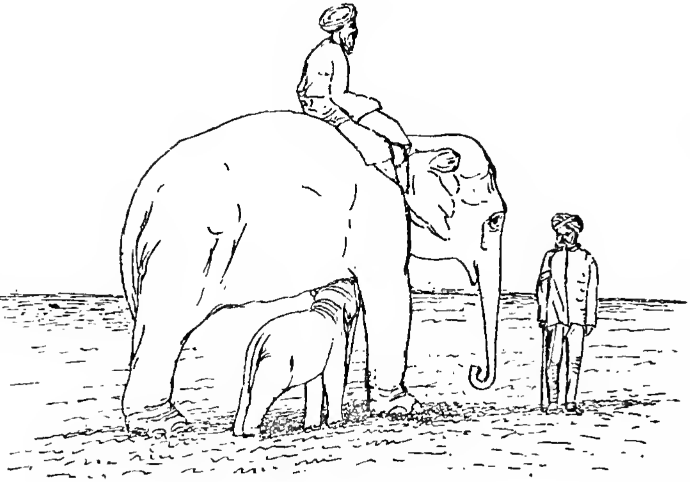

FIG: 1. YOUNG ELEPHANT SUCKLING.

(FROM A PHOTOGRAPH BY Mr JNO PORTER, SCHOOLMASTER, 2ND BTN BEDFORDSHIRE REGIMENT)

FIG: 2. ELEPHANT DAM WITH CALF.

(FROM A PHOTOGRAPH BY Mr JNO PORTER, SCHOOLMASTER, 2ND BATN BEDFORDSHIRE REGIMENT.)

PLATE, 2.

ALEX BARREN, LITHOG MADRAS. 1885

habit. The pace adopted by the elephant on his migrations is the walk—only when frightened or annoyed does he assume any faster rate of locomotion. When he comes to a river he fords it if the bottom be good and the water not deep but he crosses deeper rivers by swimming, his body being well down in the water and only the end of the trunk out for breathing purposes. He is proverbially sure footed and will often travel over very rough ground, he has been known to charge uphill or down, never falling although constantly making false steps or slipping (Young Shikarry). The march of the herd, in consequence of the conformation of the foot and the soft nature of the ground traversed, is remarkably silent, so much so as to prove a means of protection against Shikarees. The elephant is said to sleep only 2—4 hours and in the wild state he generally reclines flat on his side.

The progress of the wild elephant through his migrative voracious life is varied in its even tenor in various ways. Sometimes while engaged in rooting up bulbs and other dainty morsels of food with his tusks or obtaining leaves and branches by means of the trunk, he is set upon by carnivores, but few of whom, however, dare assault the giant of the forest. Again, Elephants sometimes fall victims to inundations, and, perhaps, jungle fires, or to starvation in seasons of drought. But their direst enemy is man. In vain does the whole race retire from the energetic forest destroying human being, vain are strength and valour against firearms and other ingenious lethal devices of man. Snares and pitfalls sadly reduce their numbers—and it seems that, after survival through many vicissitudes and ages, the race of elephants must at length be exterminated by Mankind. Their non-extermination hitherto has been accounted for already as being to an extent due to certain points of conformation, it is dependent also on longevity. Sanderson says " I think it by no means improbable, looking to their peculiar dentition and other circumstances that elephants live to 150 or 200 years." The natives of India attribute to them an average life of 80 years, but fix 120 as the maximum. Some domesticated elephants have, like old trees, become historical; thus Tennent tells us that "amongst the papers left by Col. Robertson, who held command in Ceylon in 1799 shortly after the capture of the Island by the British, I have found a memorandum showing that Decoy was then attach-

ed to the Elephant Establishment at Matura which the records proved to have served under the Dutch during the entire period of their occupation extending to upwards of one hundred and forty years, and it was said to have been found in the stables by the Dutch on the expulsion of the Portuguese in 1656."

The many curious ideas concerning *what become of elephants that die naturally* are noticed by Sanderson:—(1) The Cingalese say they retire to an universal sepulchre; (2) Others say that jungle fires burn their bones; (3) Others affirm that they sink into the beds of morasses; (4) Sanderson concludes that only five per cent. die annually and that we do not know what becomes of their remains; certainly but few bones are found in the jungle. However Wallace observed many in Java, as mentioned by him in his "Malay Archipelago." Considering the low rate of mortality under ordinary circumstances, the unexplored nature of their habitat, the liability of their carcasses to be devoured by jackals, hyænas, and other bone destroying carnivora, we hardly believe that this matter is so mysterious as has been supposed. When an animal falls sick he is expelled from the herd—a wise provision of nature against the spread of epizootics.

The *influences at work tending to reduce the number of elephants* are :—

I. The limiting of his range by destruction of forests, &c.

II. The influence of man—

(1) Capturing him for domestication.

(2) Hunting him either for sport or in defence of crops.

(3) Destroying him for the sake of ivory.

III. The straits to which he is put by accidents, droughts, famines, and epizootics.

IV. The fact of the elephant being uniparous (very seldom bearing twins), and having a long period of uterogestation.

V. The fact that elephants seldom breed in captivity.

For economic reasons, and not through "a noble reluctance on the part of the proud animals to generate fresh slaves for men" as has been supposed, elephants are captured rather than bred. Twenty-five years would be rather a long period to have to keep so voracious and expensive an animal as an elephant before he attained his full working value and the cows would require special care during the long period of pregnancy—again, it is

found that breeding in captivity is uncertain, although semi-wild animals breed freely in Siam and Burma, and the Carthaginians used to breed elephants. Probably the deficiency of sexual instinct among domesticated elephants is due to underfeeding, for Sanderson tells us that in elephant management the chief point is that they do not get enough to eat, partial starvation being frequent. The march of captured animals from the jungle commences in February, they reach Dacca in May, are then put into training, and by November are quite steady and drafted into the military service (Sanderson).

The process by which the Ceylonese elephants are shipped for conveyance to India is graphically described by Tennent.—Four or five are conveyed in the same dhoney or native boat and ferried across the narrow strait (afterwards vessels with hinged sides were used). The boat is three parts filled with palmyra leaves and the elephant backed into it by use of the goad—he fights energetically against his fore legs leaving *terra firma*. Hannibal conveyed his elephants across large rivers by means of island-like rafts specially prepared with a great deal of earth (Silicus Italicus; Bk. iii.). Elephants are habitually swum across the Ganges from Dacca and will remain for a long time swimming without inconvenience In 1857—60 between 800 and 900 elephants were brought to Dacca from Moulmein or Rangoon in sailing vessels, but a vast number of casualties resulted, mainly from slinging, and it was found that the abrupt transition from a damp climate to a dry one (with a complete change of food) proved very fatal; so it was decided in future to march them up by land. Some escaped and others died *en route*, and over 30 per cent. died in 1866-7 as a result of their being subjected to native mismanagement at Chittagong. The introduction of European management materially lessened the fatality.

INTRODUCTION.

PART II.

THE ELEPHANT AS USED IN MODERN ARMIES.

In the previous Chapter we have dealt with the question of elephant supplies to the Army, and have seen firstly, that Breeding Studs, though practicable, are not economic, and secondly, that Sanderson practically proves capturing is an actual source of income to Government, and, withal, fully adequate to present requirements for public purposes. The Elephants of the Commissariat, he considered, might be reduced to one-third of their numbers at the time when he wrote, and we find that 600 Transport Elephants in future to be kept by the Indian Government was fixed by the Army Estimates for 1883-4; Five per cent. more being allowed for casualties. Sanderson, further urged they serve for a long time, and the cost of their keep may be much reduced. Thus, he estimated, a saving of Rs. 4,38,000 *per annum* would be effected by reform of elephant feeding in India. The present price of a good baggage elephant he puts at Rs. 2,000 and shows that the largeness of this price is due to Government monopoly of capture. The important question of whether elephants are really essential to Government and economical in these days of machinery and train locomotion is one we are not here inclined to discuss in full detail—suffice it for our present purpose that they are used in numerous and diverse ways in military operations.

Elephants on admission into the service should be in good health—that is, free from obvious defect in eye-sight and, especially, limb—their respiratory powers are seldom defective. In considering the limbs of this animal, we must include under this heading the proboscis or trunk (the "hand" of the elephant, as it has been called) and remember that any defect in power of movement or injury to the end of this important organ is a serious unsoundness. The *Signs of General Health* are:—*skin*, nearly black, the light parts to have a healthy pink tinge; *mucous membrane of mouth* of a rich pink colour without black spots; *eye* bright and clear; *pulse* normal; the animal should sleep well 2-4 hours during the night and at once on awakening recommence eating. When awake should be constantly on the move with trunk,

ears, and legs—and should feed well (Slymm). In purchasing an elephant we should make it lie down and tap smartly all over the sole of the foot,* for the dealers plug sinuous ulcers of this part with great skill. Galls of various kinds are liable to heal superficially and then recur and accordingly should be specially looked for in examinations for soundness under the saddle, on the forehead, and in other likely positions. Both Ouchterlony and Forsyth touch on the question of examination as to soundness. The hints they give are good and are summarized in our notes as follows:—Examine *eyes*, then *trunk* for age and general state of the health; *ears* for scabs and ulcers at their supero-external parts and junction with the head, also their free margins and the ear holes; the spine for saddle galls, warts, and so on. Look for galls on belly, withers, loins, and shoulder; feet for wear and absence of disease; try the paces, and examine as to age, docility, and degree of training. The selection of the animal, of course, depends to an extent in the work required from him. The most generally useful are of medium height; with large barrel; large broad, *straight* back (such being generally sound and free from galls and better adapted for carrying a howdah than a highly arched one; massive head; open chest; a mukhna is the best, and a cow better than a bull; height medium; age at least twenty years, preferably somewhat more.

The following summary from a Singalese book on the Elephant may prove interesting to the reader. *Marks of inferior breeding*:—eyes restless; hair of head of mixed shades; face wrinkled; tongue curved and black; nails short and green; ears small; neck thin; skin freckled; tail tuftless; forehand lean and low. *Marks of perfection*:—skin soft; tongue and mouth red; forehead expansive and hollow; ears broad and rectangular; trunk broad at the root and blotched with pink in front; eyes bright and kindly; cheeks large; neck full; back level; chest square; fore legs short and convex in front; hind quarters plump; five nails to each foot all smooth, polished, and round; tail sometimes touching the ground.

The AGE is to an extent shown by the teeth; but the size, state of the tail, and the condition of the ears, feet, and trunk assist us

* In a good working beast the lower margins of the toe nails will be found worn.

in judging. Thus the aged elephant has the end of the trunk mottled and its bend worn and cakey (Ouchterlony) and "legs almost uniform in girth throughout." Instead of walking firmly and planting the feet flat he brings them to the ground somewhat in the manner of a plantigrade animal, touching with the heels first,* a method of progression which frequently results from the animals being put to draught work prematurely; the ears frayed and the top lapping over; *skin* wrinkled shiny and shrivelled (often beset with peculiar stellate warts); *head* lean, deep hollows above the eyes; *tail* hard and caked; and with little hair left on it, body hairs worn short by friction. With regard to size, the maximum is attained at about 35 years of age, before when the animal is often timid and deficient in powers of endurance. *Teeth*: The tushes afford indications of age appreciable to natives—Sanderson erroneously affirms they are never renewed or shed. They vary much in different varieties, and, no doubt, his remark applies to some—however, in others the milk tusks are shed between one and two years of age and replaced by the permanent ones which often attain seventy lbs. weight in the male. The nonoccurrence of tusks in many Indian elephants of course tends materially to reduce their value as indicative of age. Thus in many Ceylon Elephants small Tusks distinctively called Tushes are found. In some animals the tusks grow so large as to become cumbersome or to split lengthwise. In such cases (*vide* Commissariat Code, para. 1782) they are to be cut every 1st April, and the ivory sold. The price of metal bands to be fastened round to prevent splitting is authorized as a legitimate charge. The tusks of all animals which die are to be sold and the price realized to be credited to Government.

"The first set of grinders or milk teeth are not shed, but are gradually worn away during the time the second set are coming forward, and as soon as the body of the grinder is nearly worn away the fangs begin to be absorbed. From the end of the second to the beginning of the sixth year the third set come gradually forward as the jaw lengthens, not only to fill up this additional space but also to supply the place of the second set, which are, during the same period, gradually worn away and have their fangs ab-

*Thirteen years among the Wild Beasts of India."

sorbed. From the beginning of the sixth to the end of the ninth year the fourth set of grinders come forward to supply the gradual waste of the third set. In this manner to the end of life the elephant obtains a set of new teeth as the old ones become unfit for the mastication of his food. The milk grinders consist each of four teeth or laminæ, the second set of grinders of eight or nine laminæ, the third set of twelve or thirteen, the fourth set of fifteen, and so on to the seventh or eighth set, when each grinder consists of twenty-two or twenty-three; and, it may be added, that each succeeding grinder takes at least a year more than its predecessor to be completed"* Gilchrist's ideas were much less exact than those of the experienced observer just quoted. He tells us that at about eighty years of age the front parts of the teeth—"eye teeth"—drop from the lower jaw, and that in extreme old age the molar teeth are worn level with the gum. It is evident that for practical purposes but little exact information as to age can be derived from the teeth of the elephant in our present state of knowledge. We must be guided in purchase to an extent by the statements of the seller, endeavouring to confirm them as much as possible by observation of the conditions of ears, trunk, &c.

Elephants bought for the Commissariat† are to be not less than 15 nor more than 30 years old, and growing elephants are to be measured annually on 1st April in order that the amount of their feed may be regulated in accordance with their size. It seems that elephant dealers are not above suspicion, for Forsyth tells us, though Bengal landowners sell young useful animals "at Sónpúr fair, Mahommedan dealers bring the halt and the blind. A dangerous mankiller reduced to temporary harmlessness by a daily pill of opium and hemp; Kándi sores plugged; Sájhán cracks packed with tow; sore backs surface-healed; animals so bedizened with paint, and so fattened with artificial feeding, that it is hard to tell what any one of them would look like if stripped to the bones, space so confined and crowd so great that you can't get a fair trot. Such are a few traps for the unwary elephant buyer."

The regulation allowance of FOOD for Government elephants is

* (Corse, in Brewster's "Edinburgh Encyclopædia.")
† Commissariat Code, para. 1768 (1882).

laid down in paras. 1769-1774 (inclusive) of the 1882 Commissariat Code. It comprises Ratib and Forage. The *Ratib* consists of Atta (coarse wheat flour), or rice of the third quality, or of Dhán (unhusked rice) in twice the amount of either Atta or husked rice. This grain is to be cooked by baking on an iron plate, and made into cakes or chupatees weighing about 2 lbs. each. Mussalas (also sometimes salt and oil) are issued free in the form of allowance to the Mahout. The oil is useful for external application; firewood also for cooking is allowed them. No ratib is allowed for Naga (suffering from indigestion) elephants, the dates of sickness and recovery of which are to be noted on the feeding bills; also "Musth" elephants are to get only half ratib, the value of the remainder to be spent on green fodder. In Bengal increased fodder in lieu of ratib is allowed on production of a certificate of disbursement.

Scale of Rations for Elephant.

Size.	In Cantonment.						On Command		At Graze.	At Sea.				
		Fodder.									Fodder.			
	Grain.	Dry.	Green.	Bhoosa.	Salt.	Oil.	Grain.	Fodder.	Grain.	Grain.	Dry.	Green.	Salt.	Water.
	lbs	lbs	lbs		oz	oz	lbs.		lbs.	lbs.	lbs.	lbs.	oz.	gals.
1st Class 8 ft. and over ...	15	200	480	...	2	1	15	As when in Cantonment.	15	20	170	320	2	50
2nd Class under 8 feet ...	15	150	320	...	2	1	15	do.	15	18	150	300	2	40

(a). When paddy or rice is issued to elephants 10 lbs. of grass or straw is allowed per elephant per diem for tying up the grain in the small bundles known as Koojra, to prevent waste.

(b). The dietary scale is sanctioned tentatively pending the results of experiments on elephant feeding.

(c). All changes of diet to be graduated.

Sanderson wrote on this subject when the keep of each Government elephant averaged Rs. 50-80 per mensem. The grain ration in Bengal being daily per elephant 9 seers of (dhan) unhusked rice or of wheaten flour; in Madras 12½ seers of cleaned rice. Green fodder was allowed at the rate of 400 lbs., dry 250 lbs. (Bengal); green in Bombay, 340 lbs.; in Madras, 250 lbs. green

or 125 lbs. dry. He considers the Bengal allowance sufficient if the grass be good, but that at least 800 lbs. of frontier coarse grass should be given. He argues against the use of grain ration which is the most expensive article of food and (he considers) is not necessary for :—(1) When wild elephants have none; (2) Nor when under native owners, although they are severely worked; (3) Cooked food is unnatural and the nutritive value of rice is doubtful; (4) Most of the grain is appropriated by the attendants who systematically pilfer. He surely would not argue that *no* grain is required! When wild the elephant gets grain in husk and growing; also nutritious roots and bulbs such as contain much starchy material. The statement that rice is of doubtful nutritive value is no longer in force, for recent experiments have shown that rice gives the best nutritive result with the least expenditure of vital energy on digestion. The refinement of cooking the ratib is certainly superfluous, but we must hesitate before introducing any innovation on systems which have answered for a long time. Possibly the firewood for cooking is a Mahout's perquisite, like many of the ingredients of mussauls and much of the rice ratib. Many mahouts reckon on keeping a large family of several generations out of pickings from the Sahib's or Sirkar's elephant. Any reduction in allowances (indirect) thus given to these men will arouse the conservative tendencies of these natives and unless the strictest supervision be exercised the elephant will shortly be found starving. At present few get more than the bare necessaries of life. Ghee (clarified butter), half a pound, or else jaggery (coarse sugar), one pound, used to be commonly given in the ratib. They are valuable nutritives, but, it is to be feared, generally proved so to the attendants rather than to the elephants.

Tamarind is sometimes added to the Ratib but is said not to be good in the cold weather. Its laxative properties are valuable during the hot season.

The spice balls known as *Mussauls* are given once a week. They consist of various aromatic vegetable substances such as cayenne pepper, assafœtida, ginger, garlic, caraway, &c., all peculiarly agreeable to the native interior economy and much appreciated as curry stuff. If these be given in full amount under intelligent supervision, they are very useful—promoting the digestive func-

tions and supplying the place of aromatic plants which are partaken of freely by the wild elephant. The enormous bulk of the elephant's fodder seems to render some such addition essential, and experience seems to show that almost all animals in tropical climate, from man to the ox, require some such artificial stimulant to the digestive organs, especially during hot weather.

Wild elephants like other herbivora resort freely to salt-licks, They are often captured by surrounding these places with a stockade. The *salt ration* is most valuable in promoting digestion and in freeing the stomach and bowels from parasites so liable to be transferred into them with the large quantity of green forage. With regard to the *Fodder or Cherrai* ; since this constitutes so much of the large quadruped's dietetic support it requires the greatest exercise of care to ensure that it be good in quality, sufficient in quantity, clean, and palatable. Also it must be given at the proper time of day and in accordance with the season of the year. In thinking of the elephant in relation to food we must not lose sight of the general principles of food and feeding. The remarkable resemblances between the alimentary canal of this animal and that of the horse should guide us to an extent. We should also as much as possible imitate nature in our treatment of domesticated animals. The elephant is fastidious about his diet, he beats his grass against the fore legs to free it from dirt, and will refuse slimy grass or branches and leaves covered with bird's dung—his grass-food requires to be cleaned and picked over like the grass of horses in India because, especially when the Mahouts are given an allowance for cutting fodder free of cost, useless grass, faded leaves, and rubbish of various kinds is often supplied instead of good grass or hay.

"The golden rule to be observed with an elephant is to give him enough to eat" says Johnstone;* at least 3 maunds of eatable stuff (10 maunds ; Ed.'s O. S. M.) per diem should be allowed in addition to his ratib. No doubt grazing when possible is the best method of feeding but sufficient range is not always procurable and in the hot season grass runs short, even then, however,

* Johnstone's Fodder Dietary (Bengal).

January	Kerbee.
February to the end of May	Kerbee or Sugar-cane.
June to August	Kerbee or green Dhan.
September to December	Green or dry Kerbee.

the branches of trees can be obtained and the leaves which constitute their hot weather foliage. Slymm says, "My opinion is that grass should form the principal kind of green fodder all the year round, and that either on the march, or when the good kinds are not obtainable, or as a kind of variation, its use may be substituted either by banian, jack tree, peepul, bamboo, plantain leaves, fresh paddy straw, or sugar-cane. The plantain leaves I would not recommend during cold or chilly weather."

At the commencement of the rains when the grass springs up very plentifully the ratib of grazing elephants may be reduced. With regard to the use of branches and leaves as cherrai it must be remembered that it is easier work to break off large branches than to select grass. Therefore the attendants prefer to give the less nutritious branches; however the latter must necessarily be used in many places where a sufficiency of grass is not procurable and they are best for food when the twigs snap rather than bend under pressure, for branches are not relished when the sap runs (Sanderson). To deal satisfactorily with the question of what trees and grasses may with advantage be given to elephants would require a more extensive acquaintance with Indian Botany and vernacular names of plants found in the peninsula and also in British Burma than we can bring to bear. We may enumerate the following—quoting authorities. *Bamboo* (Forsyth) will not, alone, be taken as food for long; the young shoots are very acceptable and nutritious; it is good in the cold season (Slymm). *Kurbee*, millet stalks are useful for a short time but soon a change to green food is required (Forsyth). It is not suited for new elephants—which, for the first three months should be fed on green cherrai (Johnstone). *Sugarcane* is good in small quantities and is a great treat (Forsyth).

Fresh Grasses—

(1). *Kusseelah* or *Kussalah* (Gilchrist and Slymm).

(2). *Lavaloo* (Gilchrist); and *Ghut lavaloo* (Gilchrist and Slymm); and *Chit lavaloo* (Gilchrist).

(3). *Puttairah* (Gilchrist and Slymm)—or *Gutaoloo.*

(4). *Panee-ka-Arecalee* or *Rakhsee* (*Poh, Hlapareahi*) found in tanks during the rains, mixed with a weed considered liable to purge and cause the disease known as Lungun.

(5). *Typha elephantina*—perhaps the same as (4). It also is found in tanks during the rains.

(6). *Pokhla lavaloo* or Budh.

Trees, branches of, (Gilchrist). The inner bark of the larger, and the whole of the smaller, branches are used.

(1). *Rahmbuhd* (*Babool*)—*ka-jahd*—valuable.

(2). *Nahnddroo-ka-jahd*—better than 1.

(3). *Piplee-ka-jahd* „ „ 2.

(4). *Bhud-ka-jahd* „ „ 3.

(5). *Peepul-ka-jahd.* Good, but the leaves are not given in hot weather as being considered liable to cause Enteritis and opacity of Cornea.

(6). *Goolaree-ka-jahd*—unwholesome, especially to sick animals.

(7). *Bahns-ka-jahd* not of much value.

Tennent in dealing with the *Food of the Elephant* tells us that "His favourite foods are the palms, especially the cluster of rich unopened leaves known as the "cabbage" of the cocoanut, and areca; and he delights to tear open the young trunks of the palmyra and jaggery (*Caryota urens*) in search of the farinaceous matter contained in the spongy pith. Next to these come the varieties of fig trees, particularly the sacred *Bo* (*F. religiosa*) which is found near every temple, and the *na gaha* (*Messua ferrea*) with thick dark leaves and a scarlet flower. The leaves of the jak tree and bread fruit (*Artocarpus integrifolia and A. incisa*), the wood apple (*Ægle Marmelos*), Palu (*Mimusops Indica*), and a number of others well known to their attendants, are all consumed in turn. The stems of the plantain, the stalks of the sugarcane, and the feathery tops of the bamboos, are irresistible luxuries. Pine-apples, water-melons, and fruits of every description are voraciously devoured, and a cocoa-nut when found is first rolled under foot to detach it from the husk and fibre, and then raised in his trunk and crushed, almost without an effort, by his ponderous jaws. The grasses are not found in sufficient quantity to be an item of daily fodder; the Mauritius or the Guinea grass is seized with avidity, lemon grass is rejected from its overpowering perfume; but rice in the straw, and every description of grain, whether growing or dry, gram (*Cicer Arietinum*), Indian corn, and millet, are his natural food."

Hood urges that a timely attention to dieting might avert

many a case of sickness and subsequent loss by death. Bengali Mahouts are very fond of giving *Dhuli* or jheel grass to their charges because it can be obtained easily—but it is at least 80 per cent. mud and water combined, and "constantly purges the elephants and when fed solely on it they dwindle away to half their proper size. For grazing purposes, however, it is not so bad, as elephants if left to themselves will eat the clean tips of the Dhull, thoroughly washing them beforehand. The good effects, if any, are frequently more than counterbalanced by the myriads of leeches that infest the jheels where the dhull grows. These adhere to the elephants when they are standing in the water grazing, and bleed them copiously".

Paddy straw, Rhagi grass (Bajree or Natchenee), Cholum or Kadhy straw, and other grass crops are also used as fodder for the elephant, the total amount of which should at least equal 450 lbs. Banian, plantain, sumul, pakur, teak, dahn, amrah, purme, nurkut, bans, kurean, ocree, numdwa, and tawar are also useful in elephant feeding and recommended by Slymm. Practically, most green stuffs, grasses and leafy branches, are acceptable to the elephant and can be utilized by him as food—much must be left to his judgment in selection on the emergencies of the march and when the Commissariat Stores run short on a Campaign. The latter emergency is liable to affect elephants specially of all the animals belonging to an army. In peace they are with difficulty sufficiently supplied with fodder but in war the largeness of their food requirements militates very seriously against their use. The first elephants captured by the Romans from their enemies were killed because the Republic was too poor to keep them!

Slymm reminds us that in letting elephants loose to graze in the jungle we should take care to give them such a direction as to enable them to find good suitable fodder, shackling them well [with a double loop of cane put round both forefeet and lashed in the centre between the legs, known as the Andoo (J. H. S.)], lest they roam too far from camp, from which cause they are apt

Weather Diet—*Charra most suitable for Bengal and Assam.*

Cold—Tarra, bamboo, peepul, burgot, lahkur, pahkur, jungly burgot, jungly dhoomur, dhoodea, and sugar-cane.

Hot—Plantain trees, jungle trees, ghoolur; $\frac{1}{3}$ of bamboo, peepul, or lakhur.

Rainy—Kussaylah grass, kutra grass, plantains (a few), peepul, burgot, and bamboo a proportion (Hood).

to get more exercise and less food than we intend and require to be brought back a long way into camp and are in a state of fatigue when they ought to be fresh and fit for work. He also says "many times, in travelling, I have arrived at places which I have thought fine spots for letting the elephants loose during the night, but I have been disappointed to find that the elephants would not eat the grass I saw; on such occasions I had to tie the animals in a quiet place and feed them on rice or paddy with a little salt and give them either some plantain leaves or fresh paddy straw, but not in a very large quantity."*

When the animals work during the day they ought on returning to the lines, to be allowed to stand quiet for a short time and the mahout in the meanwhile collect the fodder, also well malish the back with his hands and feet after removal of the load, and examine the feet for thorns and cuts, the body for leeches especially during the rains. Next they should be taken to water and washed. After which and during this process of grooming some grass may be given. Then they should receive the grain ration, being drawn up in line four paces apart, and the non-commissioned or warrant officer in charge should see the rice given in the proper manner in straw or grass, or plantain husk. All the grain may be given now or a third of it reserved as a chota haziri to be given in the morning before starting on the march, and finally a sufficiency of fodder placed before them to last until the time when they should go to sleep, say at 10 P.M. Thus they should be allowed about five hours for feeding which will give them an opportunity of consuming a considerable bulk of fodder. Hunter's experiments show that in this time an elephant can consume nine seers of dhan and twenty seers of straw.† These experiments prove that it is most essential for elephants to be fed by hand with their

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* When elephants have to bring in their own fodder they should be despatched punctually every morning at day-break into the jungle, when possible under care of a Jemadar, for it is during grazing time mahouts are most frequently cruel to their elephants. They should be accustomed to carry the cherrai barebacked, the load being secured by a single rope running round the neck along either flank and under the tail, provided with gullarband and dumchi to prevent galls. If the animals be accustomed gradually to carrying the cherrai in this way it will save the guddee from wear, harden the back, and lessen the frequency of galls. In loading with fodder the lower part or basis of the load should be plantain trees or bundles of grass (Hood).

† Oriental Sporting Magazine.

grain or be supplied with grain in the straw, and, as they are such slow feeders, to be never without fodder before them while standing at their pickets during the day. They can also get a little in the intervals of their work. The slow feeding of the animal gives time for the first food taken in to pass fully digested from the stomach into the bowels and thus before midnight the elephant will be in that comfortable state of repletion which is conducive to repose.

Sleep is particularly essential although but a small amount is required to keep an animal in working order. Practical observers say that four hours regular and undisturbed sleep is necessary and sufficient, and that if elephants sleep longer than this it is a sign of disorder and of the necessity for enough rest, and provision must be made to secure this, especially on the march, by proper camp arrangements. There should be strict silence in the filkhana after 9-30 P.M. as by that time most of the elephants will have filled themselves and will lie down and sleep (Hood). Ouchterlony particularly impresses on us that the head should be up hill when the animal lies down in camp for otherwise he will be unable to rise without the assistance of two or three other elephants. He will become much distressed and must be given a stimulant, then pushed on his side to rest himself, and finally pushed on to his legs. In rising he elevates the forehand first, and in lying he flexes the forelimb at the elbow and the hindlimb at the stifle, the forefoot is bent inwards with the sole turned towards the root of the trunk, which organ lies curled upon the ground. Encamping on sloping ground will secure dryness of the lines, which is most essential because rheumatism is frequent in the elephant and also his feet are liable to disease as a result of constant exposure to moisture. In permanent lines the greatest care must be exercised to secure a proper outflow of urine by surface drainage, the channels being paved to prevent the formation of holes by a great bulk of fluid falling from a height into them.* Topes (groves) are considered prejudicial

* Filkhannah to be on banks of a small stream with sandy bed of running water, within easy distance of grazing jungles; shelter necessary for hot and rainy weather—sheds should be built—they are cheap, if built at end of cold weather when timber can be obtained for the trouble of cutting it. The mahouts and coolies to provide a certain number of logs daily until the number necessary has been obtained. Each elephant can easily bring in (with his charra) 2 logs (15 ft. × 20 ft. 9 in.) to be tied on either side of the

except during the hot weather when they are dry, free from miasma, and afford a welcome shelter from the powerful rays of the sun. The most approved elephant lines are covered sheds whereby the animals can be sheltered as well from the cool of the early morning as from the heat of midday and the cold of monsoon rains, conditions equally prejudicial to the animal. These buildings should be on high ground, open to breezes, and a wooden stout flooring at some elevation from the ground is useful, but not essential if the soil flooring be of kunkur or morrum and kept in good order, in the same way as the flooring of horse lines.* When

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animal on the top of the charra, the ends resting on the ground. *Gullerbands*, leathern neckpieces, through which the stout neck-rope securing the logs passes, should be provided for this work as the animals are liable to get galled about the neck and chest when transporting timber in this wise. SHEDS should be open at sides and give space 22 ft. × 22 ft. for each elephant and be 20 ft. high. To prevent the elephants getting sorefeet, to which they are very liable when chained for any length of time in one place, each stall should be paved in the centre with logs (which are the least expensive, although boards are better, (3 in. thick by 10 ft. long) under the hind feet forming a level square of 10 ft. × 10 ft.: in the centre underneath the logs a small drain should be cut to carry off moisture. This will communicate in turn with a larger drain which must be dug at a distance of 15 yards. or so in rear of the sheds, and running parallel to it two rows of stout posts should be planted, one in front and the other in rear, for securing the elephant chains, or Bhundhuns, to. The thatch of the sheds need not be more than 4 in. in thickness. "During the monsoons several casualties and much sickness will be prevented by providing them with timely shelter"—(Hood)

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* The "*Manual of Mountain Artillery*, 1882," enumerates the following methods of securing elephants :—

1. Anklet on one fore foot only, the other ankle being linked through the ring of a long chain, the hook end being secured round a tree, post, or into the ringbolt. Allows the maximum amount of liberty; to be used during the day.

2. Long chain round one hind leg, to tree, post, or ringbolt. Also suitable for day tethering.

3. The above with addition of anklets on both fore feet.

4. Anklet on one fore foot only, the other being linked on the ringbolt.

5. Both anklets on fore feet, the coupling chain through a ringbolt.

6. The above, with the addition of long chain on one hind leg; only to be allowed in special cases.

It is a good thing to protect Elephants standing in the open by low mud walls, especially if fed on dry fodder, for the bhoosa is blown away from their trunks. Elephants on service require jhools of gunny lined with blanket.

on the march elephants are generally tied to trees, in the lines they are fastened by means of a chain to a ring in the ground.* They are usually so docile that this suffices and many will voluntarily fasten it around the forelimb above the foot. So adroit are they, indeed, with the trunk, that it is wonderful they do not free themselves when they like. Males showing the premonitory signs of Must require special fastening by shackles of considerable strength and "a set of implements used to restrain unruly elephants should always be kept on hand in the cattle lines and one set should be sent with elephants proceeding on command," of course attention to this para. 1780 of 1882 C. C. is less requisite, now females only are obtained for the public service. The camping ground must be fairly smooth and freed from large stones, and plenty of room should be given to each animal so that he can move and lie down freely and not steal his neighbour's food. An elephant 10½ feet high is about 16 feet long from front of face to root of tail, so the picketting rings should be about 20 feet apart. It need scarcely be impressed on the minds of those who are in supervision of elephants that strict attention must in every respect be paid to the laws of Hygiene. It was hardly creditable to those officers who were in charge of elephants in the Kuram valley in 1879 that the Inspecting Veterinary Surgeon found the elephants there bedded down on their own dung! Water should be given twice daily, say at 8 A.M. and 6 P.M. Wild elephants usually drink after sunrise and before sunset. Good water is a prime essential for elephants on the march; they are fastidious over this even more perhaps than over food. Parkes (we know not who was his authority) is very far from the mark

* "As a rule the chains with which elephants are secured are of various patterns and sizes; either the links are so thick that only a very thin hook can be inserted into them, and their strength is thereby rendered unavailing; or they are so thin that if elephants are alarmed during a storm or by a fire in a village near they snap them and make off. Elephant fetters of the best patterns can be obtained from the Dacca Depôt. Mahouts are very fond of securing their elephants both fore and aft in the most irksome manner, though a rope or chain fastened to one foot and to a peg in the ground is sufficient restraint for most elephants. This latter mode of fastening allows them to turn to or from the sun or wind as they find agreeable. Natives think nothing of securing an elephant so that one side is exposed day and night for weeks together to wind and rain" (Sanderson).

in putting the water requirements of an elephant at 6—8 gallons, Gilchrist from careful observations has shown that an ordinary elephant will take 15½ gallons twice daily and on boardship they are allowed 40—50 gallons according to size. They must be allowed as much water as they will drink when it is available. Gilchrist informs us that "the animal generally cannot with impunity support a deprivation of water much beyond 24 hours." They require the water to be sweet and free from mud. Well water is preferable for them to tank water as being cleaner and less liable to contaminations such as turn the animal against it. The large amount of water required by elephants renders it advisable during the hot weather to picket them out or keep them in stations near small tributary running streams rather than take them into the jungle where stagnant pools, semi-dried tanks, and brackish ponds only are available as a means of water supply [Slymm]. Elephants prefer running water and will drink freely that obtained by digging holes in the sandy bed of a river. When on the march [in addition to the routine watering parades] every opportunity should be taken of allowing elephants to drink a small amount of water which taken then is not liable to do harm if the animal continue on the march. It is a well established rule that they should not be allowed to bathe or to throw water over themselves when heated, wild elephants seldom bathe after sundown. According to Slymm "when elephants used for travelling have to cross a deep river either at the end of the march (before the sun is up), or when their bodies are heated by a part of the march already undergone, they should not cross before the next morning or till the heated state of their bodies has subsided. The sudden cold of the water produces the same effect as a chill from extreme cold, which gives them the disease called "Chowrung." Hood gives the following useful details about crossing rivers and nalas with elephants :—Halt and allow to stand without guddees for half an hour before entering water. With one hundred to cross send four or five good swimmers across first and keep the remainder for the refractory. Tie the good swimmers and refractory neck to neck by slip knot, and be sure each mahout carries his knife into to the water with him. Send a Jemadar over first to select the best landing place. Make much allowance for current. Send main body of elephants after the pioneers, 2 or 3 abreast, as closely as

possible, this gives them confidence and they are more leisurely in their movements and do not distress themselves so much as when alone. Each animal to have a rope on, passing round its waist just behind the withers from which runs a short rope 5 or 4 feet long for mahout to hold on by when he stands on the elephant's back in deep water. After crossing a wide river graze for ½—1 hour, if time is no object, on bamboo leaves or Dhullee (such as boughs of peepul trees). An unknown, apparently fordable, river should be crossed by a small strong naked elephant as a pioneer. If he became involved to his breast in sticky mud he could only disengage himself by rolling over from side to side, and the load (if on) would be lost in the mud. A place where there is a little water generally has a firmer bed than where there is none. *To construct a road over an otherwise impassable nala* anything procurable should be made into bundles 6—8 feet long and 2 feet in diameter, and handed to a well trained Koonkie who will stamp them well down into the mud with her forefeet. Over these two parallel lines of logs 6 feet apart should be laid crosswise, other logs close together bound firmly by strips of cane or anything available. The thicker the logs the better, but trees as small as 6 inches or less will do. *If an elephant gets into a quicksand* the nearest articles to hand, *even the guddees of other elephants*, should be thrown to it. If the quicksand is dry throw water to loosen it. After this or any other severe exertion elephants will go off their feed and become "soost." Give mussalas with plenty of gûr and they will probably drink arrack or rum (half a bottle).

Water is also required for washing purposes. When ill cared for the skin of the domesticated elephant becomes harsh, with the cuticle much hypertrophied. *Grooming* the elephant consists of properly washing the surface of the body or rather applying vigorous friction. The mahouts use a special kind of soft stone, a lump of dry clay, or a whisp of loose nut husk for this purpose, while the animal throws water over himself with the trunk. Also in keeping the feet and natural orifices clean, and preparing for exposure to the sun by lubrification of the surface of the body with oil and ghee. It is most essential that the latter duty be properly performed and other means must be adopted when it is necessary to work or march during the hotter hours, for elephants are very liable to suffer from apoplexy, inflammation of the

facial sinuses, skin eruptions, conjunctivitis, and sloughing of the external ear and tail from exposure to the sun. The head therefore should be protected by a white padding of wool one or two inches thick or the small felted cloth on which the driver sits should be large enough to project and cover the forehead (Forsyth). The trappings generally suffice to protect the rest of the surface of the body of animals carrying a load. With a view to allowing domesticated elephants to give to themselves that protection which is adopted by wild ones they should not be prevented caking mud over the body surface however it may interfere with smartness of appearance. Good ELEPHANT ATTENDANTS are very difficult to get and in proportion to the ignorance of the Europeans in charge concerning elephant management is the self sufficiency and positivism of the mahout. Government allows to each elephant one mahout (the best come from Oudh and Chittagong) who is "held responsible for the appearance and condition of his animal and should not be unnecessarily removed from it," also one cooly (two when the animal is habitually violent or musth). Also one Bhistie is allowed per 20 elephants in Bengal. When 20 elephants are in a station one Jemadar is placed in charge. When a less number an experienced mahout acts as a Naib Jemadar. Thus the mahout must be considered equivalent to a "groom" and the coolie or coolies as "strappers". It is necessary in engaging a mahout to see that he really knows something about elephants. He is very well paid and has good position and perquisites and so should thoroughly understand his work, but few are really competent although, it seems, we are better off in India than they are in Burma. Sanderson finds that the following are the principal vices of mahouts as elephant keepers, and it will be inferred that with them as with other Indian servants all details of general management, especially the utilization of supplies in full for the benefit of the elephant, must be most strictly supervised. Mahouts make their elephants' comfort and convenience subservient to their own but are rarely wantonly cruel. They prevent them throwing dust and litter over themselves and rarely put them under a tree to protect from sun. They picket them tightly and uncomfortably with two chains allowing no change of position to avoid wind, rain, and sun. They use chains either too thick or too thin for elephant fetters. The mis-appropriation

of food, oil, and firewood has already been alluded to. We may add to this that, although nothing seems of too little value for the native to purloin, he will, unless very carefully looked after, ruin the most valuable trappings and appointments by neglect of the most elementary care and by the loss of small but essential straps and buckles—replacing the latter temporarily by some petty makeshift. It requires some little experience of Indian ways to enable an European to appreciate the careful attention to detail requisite in animal management through natives of this country. For elephants not in regular work EXERCISE is most essential. According to regulation it is not to be during the heat of the day, except in emergency. Working hours are to be 5 A.M. to 10 A.M. and 4 P.M. to 8 P.M. or on the march from an hour before daylight until the day begins to get hot. Elephants seldom sleep after 2 or 3 A.M. and therefore are usually astir early. The shortness of the neck, straightness of the fore limbs, great weight of the head, and flatness of the forehead, which adapt the pioneer elephant to his duty of forcing a passage through the jungle, are utilised in getting him to push down walls, force weighty objects onwards, and press against a fallen comrade or obstinate camel until he is compelled to rise. When the elephant is used for these purposes the head should be protected by a shield consisting of a well stuffed leather pad. Evidently by conformation the elephant is a beast of burden. Although he can perform heavy draught work this soon tires him and so does pushing. Thus when called upon to push or drag it should only be where great labour is required for a short time, as in extricating a gun or cart from a bog. The common breast harness of the Heavy Field Batteries may be used in case of draught but in emergency "The tusks are useful for lifting heavy weights, turning them over, or dragging them by means of ropes twisted round these teeth." Also elephants sometimes drag very heavy loads by means of the molars. It is most certainly a fact that the feet of this large animal are not adapted to stand such wear as results from even two or three forced marches along a level road when the weight bearing is altered and regulation of bearing on the soles is prevented by a considerable weight, such as a heavy gun, behind them—five miles a day, with frequent rests, is given by an experienced authority as quite sufficient for ele-

phants in fair condition. This fact, taken with their timidity at the sound of fire arms, suffices to show that the elephant thus utilized is out of place in any draught Battery requiring mobility and to be brought to the front. It must be always kept in mind by Commanding Officers of Artillery that they can use such Elephant Batteries only over a limited range of country. In Southern Afghanistan guns were carried on the backs of elephants in the march from Candahar to Cabul, to which it was objected that enterprising riflemen in this rough country would find an easy mark in the body of the huge quadruped. In the Elephant Mountain Batteries, such as the one at Tounghoo in Burma, the animals in being broken-in to stand fire are hobbled by both fore-legs on coming into action, and any elephant which shows a tendency to bolt has in addition the long chain with drag ropes attached to one of the hind legs. These can be manned should the elephant run and will have a powerful influence in stopping him (*vide* Mountain Artillery Manual, 1882). Elephants, also, during the Afghan Campaign were attached to the ordinary Field Batteries and, when properly used and cared for, were found generally useful. Slymm's experience of timber dragging work in Burma is that Elephants are as much unfit for this as they are suited for carrying purposes. The dragging throws the animals into an unnatural position as can be observed at a single glance. "The whole of the pressure from the breast bands lies upon the upper part of the chest, which forms the most delicate part of the animal's construction. The cavity is very narrow in proportion to animals of a smaller size. They never suffer more than when used for the dragging of timber on hilly localities. If not conducted with great care, and if they are used longer than 5 or 6 hours daily, they will soon show weariness" and "pushing timber down stream is the easiest work for which elephants can be used, as their natural construction is well adapted for it. They have strong legs and powerful muscles on the neck and trunk. They can work on this during the rainy season from morning to night without showing any signs of weariness. But with this work, the soles of the feet become very tender and apt to burst when used afterwards for travelling over hard and dry soil." Properly selected, in accordance with the duties required from them, elephants are most valuable on the march as beasts of burthen—when thus used they

can carry great weights, cover much ground, and require few attendants. The regulation load varies according to the size of the elephant and the nature of the country from 738 lbs. (in Madras) to 1,640 lbs. exclusive of gear (in Bengal). The Bombay regulation 1,200 lbs. (15 maunds) may be taken as the average and in Mountain Batteries the female elephants (7½—8½ feet high) are considered capable of carrying this load "at a pinch on a good road." In the Abyssinian Campaign some succumbed to exhaustion under overweights of 1,500—1,800 lbs. (some discretionary power being allowed to the officers in charge). Hood gives the following *scale of loads for elephants in a hilly or mountainous country* :—

7 ft. 6 in.	Elephants	not to	exceed	6	maunds.
8	"	"	"	7	"
9	"	"	"	8	"
10	"	"	"	9	"

In a level country increase by 2 maunds. Chains, coolies, mahouts, &c., weigh at least 2 maunds *(Oriental Sporting Magazine)*.

An excessive load is apt to tire the animal too soon, to make the feet sore, and to cause stumbling. This load is equal to that of three camels and of seven and a half ponies or small mules. The large amount of elastic tissue in the elephant, the uprightness of his weight-supporting limb bones, and his lymphatic temperament adapt him for sustained exertion under a burden. He will work all day long, in emergencies remaining under his load even twenty hours at a stretch but, as a rule, may be required to go fifteen or twenty miles spending about 5 or 6 hours on the move and averaging a rate of some 3 miles per hour.. "Properly laden and properly fed an elephant will easily do 12 miles per diem all the year round" (Hood). He moves at a peculiar ambling pace the two limbs of one side advancing simultaneously, this can for a short distance be increased to a fast shuffle of about 15 miles per hour (Sanderson). On the march metalled roads are to be avoided as much as possible out of consideration for the feet of the animal; no part of the body is more liable to disorder, and complete temporary incapacity results from injury to or disease of these important organs; so that we may well modify the old saying into "no foot; no elephant." We shall see this hereafter, but must now observe that sudden transitions from a long march

on moist ground to rock surface or metalled road are to be avoided. The thickness of the horn of the sole is in relation to the amount of exercise and it will be found that the feet of elephants which have been little exercised and are not in proper condition, have less resisting power than those regularly worked in moderation. The mahouts as a precaution against overwear of the feet resort to a process called "Chóbing," applying a hot mixture resembling coal tar (one ingredient of which is generally the gum resin of the Sál tree) to the sole. The applications used for this purpose vary somewhat. That referred to by Forsyth is preserved as a secret Recipe by the mahout; it requires to be applied twice annually to an elephant working regularly on hard ground, the price of the operation being Rs. 2¼. Gilchrist gives two *Recipes for Chóbing*—each contains fourteen ingredients which are either astrigent or adhesive or vehicles.

	I		II	
Equals practically Catechu 3 lbs.	1 Aloes ... 2 lbs.		Aloes............ 4℥	Astringent; equals practically Catechu, 12℥.
	2 Catechu .1 lb.		Catechu......... 4℥	
	3 Tender Ink nuts 4℥	=	Tender Ink nuts 4℥	
	4 Sesquioxide of lead......... 8℥	=	Sesquioxide of lead... 2 tolahs.	Neutral can be omitted.
	5 Country gooseberries 8ʒ	=	Country gooseberries 8ʒ	
	6 Wax ... 2 lbs.	=	Wax .... 2 lbs.	Vehicles.
	7 Jingili oil 6 „		Jingili oil... 4 „	
			Tolahs.	
Vehicles............	8 Suet ... 2 lbs.	—	White arsenic 1½	Unimportant being in too small amounts to have much value.
	9 Jageery. 6 „	—	Croton seeds...4	
	10 Lahk ... 1½ „	—	Alum 6	
	11 Black gram.4℥	—	Litharge 2	
Equals practically Markingnut 6 lbs Gum......... 1½ „	12 Common salt 1 lb.		Columbo ...... 8℥	Equals practically Galls, 1 lb.
	13 Areca......1 „		Galls............ 8℥	
	14 Marking nut 5 lbs.		Ink nuts... 4℥	

By thus analysing and examining Gilchrist's recipes we obtain the following:—

		lbs.
I.—1.	Catechu powdered	... 3
2.	Marking nut do	... 6
3.	Gum of Sál tree	... 1½
4.	Wax	... 2
5.	Jageery	... 6
6.	Suet	... 2
7.	Jingili oil	... 6

Melt together: apply when liquid to the thoroughly cleaned sole of the foot.

			ozs.
II.—1.	Catechu powdered...		12
2.	Galls...............	lbs.	1
3.	Wax...............	„	2
4.	Jingili oil	„	4

Melt together: apply to soles of feet night and morning.

III.—Take a large quantity of the bark of the jack and palmyra trees; boil it with plenty of water for about four hours till reduced to about 6 or 7 quarts, then strain it through a cloth, and, while hot, add the following:—

Cutch ... 2 ozs.
Soda ... 2 „
Wax ... 4 „
Oil ...... 2 bots.

} make the elephant to lie down in the position as while sleeping, the crevices or cracks should be well cleaned of mud and sand by washing—after which apply the medicine hot by gently hitting the soles of the feet for a few minutes with a piece of rag fastened to a stick and soaked in the application. (Slymm).

Government sanctions Chobe (in Bengal) but the cost per elephant is not to exceed 12 annas; in Mountain Batteries it is allowed whenever considered necessary. Various kinds of boots have been tried from time to time to prevent excessive wear of the feet but the enormous weight and peculiar movement of the elephant renders them of but temporary value for they are soon worn out even though the boot of leather be shod with an iron shoe. This is, however, a very useful surgical means in cases of sore feet, for retaining dressings. Indeed from its peculiar form, especially on very flat and moist but hard ground, the foot acts as a kind of sucker, as is concluded by Slymm from a remarkable accident which happened to him when on the march "one of my elephants when crossing a small river in which the water rose to a little above the belly of the animal, in descending made the motion of slipping from the side of the stream to its middle, and there he remained without being able to go any further or move a foot. I sent men down but they could ascertain nothing else than that his feet were surrounded by blue clay. Everything tried to free the animal was fruitless, till at last, but not before

the next day, I directed the nullah to be dammed up and the water baled out with native pots; when this was done and the clay below the animal was removed, we found that he was standing upon a solid rock, upon which the form of his feet acted like suckers. It was with great difficulty we succeeded in admitting some air below the soles of his feet after which he soon ascended the opposite bank and after having been fed in the choung for more than thirty-six hours."

Gilchrist remarks that the elephant goes on his hind knees down an incline, on his fore knees up. We also are told that he can climb steep but soft banks of nullahs by so moulding the clay as to form steps for himself, but the authority for this statement is doubtful. It is certain, however, that in crossing boggy places, and to extricate himself from sloughs and quicksands he will place bundles of wood, branches, or fascines beneath his feet. In all cases as a preliminary to crossing rivers the load should be removed, for the weight of the elephant (over three tons) in itself suffices to render passage difficult when the bottom is muddy or of clay or loose sand. The peculiar position of the elephant in swimming will compel the mahout to *stand* on his back, they swim freely and for a considerable distance and are seldom drowned in passage of deep rivers. The great care exhibited by the elephant in securing a firm foot-tread has become almost proverbial, and he can only with the greatest difficulty be persuaded to cross any structure, such as a bridge, which he considers insufficient to support his huge weight. Experience would seem to indicate the inadvisability of forcing the animal to cross a structure which he seems to consider insecure. It is not the least remarkable proof of the tractability of this animal, that, in spite of this instinct of self-preservation, he may be taught to walk on a tight rope! Since a large elephant weighs with his load some 3 to 4 tons a bridge which will support him is probably well fitted for ordinary army passage. It is estimated that a loaded elephant occupies a space 99 square feet, and an unloaded one 11 feet by 5 feet; and they cannot be made to crowd together (Sir G. Wolseley). On the march they generally proceed in Indian file and so considerably lengthen the column and increase the the number of guards required in a hostile country. Whenever possible they should advance in line and can be kept well up against the fighting body

at a rate of 3—3½ miles per hour and without halts; they will not be left far behind in a 10 to 15 miles march.* Although the elephant is very sure-footed, round stones on smooth ground and stony roads seriously incommode him. Yet it is familiar to any one who has been among elephants with what facility he will walk along the beds of streams even although there be many large and sharp stones in the way, finding, somehow or other, means of obtaining hold for his large feet. Dry nullahs and ditches prove serious obstacles to the elephant for he cannot leap on account of the perpendicular position of his limb bones and the smallness of his hind-hand, a trench 8 feet wide and 8 feet deep is quite impassable to an elephant. The same conditions also account for the liability of the elephant to fall backwards on ascending mountains when bearing considerable loads, which he is sometimes required to do in the emergencies of service; "whenever they fall under the immense burthen usually placed on their backs they never rise again, even on a good road," says Bernier, who travelled into Cashmere with Aurungzebe (" *Travels in the Mogul Empire*"). He also relates a peculiar accident in the following terms: "The king was followed by a long line of elephants, upon which sat ten ladies, in mik-dembers and hauzes. The foremost, appalled, as is supposed, by the great length and acclivity of the great path before him, stepped back upon the elephant that was moving in his track; who, again, pushed against the third elephant, the third against the fourth, and so on until fifteen of them, incapable of turning round or extricating themselves in a road so steep and narrow, fell down the precipice." The absence a ligamentum teres to the hip is an anatomical indication that the elephant is best adapted for movement on level ground and also that he is not fitted for draught purposes. Some varieties, notably that of Nepaul, are better suited for mountain work, being larger behind in proportion to the forehand than the others, even in hilly countries (as Abyssinia) elephants have done good military service.

We have already noticed how persistently the elephant stands; this has been much exaggerated in early descriptions of the animal, perhaps in consequence of Master Will Shakspere having

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* On the line of march with Artillery in India the Elephants are not unfrequently at the halting place before the Battery arrives.

written "the elephant hath joints but none for courtesy." The feats of our ordinary circuses disprove this assertion, still there are anatomical explanations of this ability to retain the standing position for a long time. It is said that in a state of nature the tusks are used as a means to support by being placed against a tree; and one imprisoned elephant "employed his tusks in making two cavities in the two faces of a stone buttress which projected from the wall of his cell, and these cavities served him for a support when he slept, his tusks being fixed in them"; so runs the account. But we know very well that the structures of the limbs of the elephant, like those of the horse, are so arranged as to enable the animal to sleep standing. Tennent relates a case where an elephant shot dead by a single bullet remained *standing.* The elephant, like the camel, is very chicken-hearted when sick, and will not attempt to rise, but if made to do so he will remain standing. When a sick elephant lies down it is a very bad sign. When marching it is well to be on the road at the hour preceding dawn because often it is then very cold, an influence to which elephants are extremely susceptible. When thoroughly chilled by cold weather or by use in a cold climate the animal loses its vigour and the circulation is retaded rand difficult to restore; he struggles, shivers, falls, and grows weaker until he dies; unless aroused by the timely administration of cordials, such as ardent spirits in doses of 1 pint to 1½ pints made up into mussauls with large quantities of spices formed into chapatties, some of which should be always carried on the march in a cold country.

The subject of Elephant Gear and Appointments is one which requires much and careful attention. The most approved patterns of equipment are by no means generally adopted, galls and chafes are the most frequent source of incapacity on service. The complicated riding equipment of the Mogul emperors consisted principally of *mik-dembers* described as small houses or square wooden towers gilt and painted, or *Hauzes,* oval chairs, with a canopy of pillars, superbly decorated with colours and gold. Now for riding purposes we use either a sort of gig body with hood, a Howdah (Shootur Khana), or a Chárjameh. The form of Shootur Khana generally used somewhat resembles an "Inside" Irish Car. The Sportsman will find a good description of Howdah and equipment in the "*Field*" for 29th April 1882.

The Chárjameh is like an "Outside" car without the "Well." Some pads are convertible into riding saddles by addition of foot boards. Sanderson has introduced a special riding saddle or chárjama which "seats four people comfortably, has large leather wallets for clothes and odds and ends; and weighs only 120 lbs."

Indian Commissariat Code: Appendix 41, para. 1780 gives the Regulation Scale of Elephant Gear (approximately) as follows:—

(*a*) 1 Guddeyla of quilted numbda.

(*b*) 1 Guddee of strong gunny stuffed with rushes, or with *Shola* (which is lighter).

(*c*) 1 Neem guddi (or iron saddle in lieu).

(*d*) 1 Jhool.

(*e*) 1 Neck rope* and Kellawa }
(*f*) 1 Girth rope and Paytie } Certain portions of these ropes are sheathed with leather to prevent abrasion of the skin. An iron tube to surround the rope under the tail to prevent galling is under trial. Oil is allowed for soaking the leather around the ropes, also for the rope under the tail.

(*g*) 1 Load rope.

(*h*) 1 Ratib bag (Dana-khorie).

(*i*) 1 Tawah (Iron Chupatti plate).

(*j*) 1 Leather bucket or dolchi, with rope.

(*k*) 1 Bherie or Undhoo—a hobble for the fore feet.

(*l*) 1 Bhundun† or lungur—a long chain for fastening the hind leg.

(*m*) 1 Kanass for fastening the bherie to the ground.

(*n & o*) 1 Iron gumaila and 1 broom per elephant, as line gear.

(*p*) 1 Sirhee or head cover per elephant }
(*q*) 1 Akree. }
(*r*) 1 Spear to four elephants }
(*s*) 1 Sulletah. } (In Bombay).

(Small neck bells are useful in the jungle in the event of the animal getting loose at night).

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* These ropes should be of jute and not too tightly twisted; handmade ones are the best. Cotton ropes (2 in.) are necessary for Houdahs, 1¼ in. for Charjahmehs (Hood). *Kellawas* are rings united by plaited rope used as stirrups. *Payties* are, properly, breastplates of well tanned thick cowhide through which the rope that passes round the elephant's body goes.

† Hood considers 2 Bhunduns necessary and insists that all these chains be as light as is consistent with the necessary strength.

(*a*). The Guddeyla may be of felt covered above with gunny or stout doosootee, below with coarse cloth or quilted cloth about 1½ inches thick and six feet square, thus reaching half way down the animals sides and from nape of neck to croup. It should be large enough to allow of the ends folding under the guddee, front and rear, to keep it level (Hood).

(*b*). The guddee or pad used at Hoonsoor consisted of two bags of gunny filled with rushes each 4 or 5 feet long, 1 thick, and 2 broad, and joined sideways at each extremity. That in common use is only a pad 9 inches in thickness, 5 feet broad, 6 feet long consisting of stout sacking stuffed with grass. "The outer case should be of stout upcountry páth, sewn with strong skin—each elephant should have his own guddee; he should wear it a few days when collecting fodder, it will thus become limp and its upper surface can be filled with a thin layer of grass to prevent the solah cutting through the cloth. The sides of the guddee where the ropes press should be protected with leather or bamboo" (Hood).

(c). Over this the neem guddi, resembling a small Hoonsoor pad, is sometimes placed—and the whole retained by a loading rope which is specially arranged to form girth, croup and breast strap as follows "one end is converted into a loop, sufficiently large nearly to surround the body of the animal and the pads. It is tied on the top, the double rope is thence passed simply round the neck, then along the upper sides of the pads, then below the tail, and finally tied again at the place of the first knot on the top" (Gilchrist). The average weight of the whole is 200 lbs. *Sanderson's Elephant Pad or Saddle* * consists of 2 pads or pillows entirely detached, each 4 feet long, 15 inches wide, and 6 inches thick, consisting of blanket covered with tarpaulin and encased in stout sacking. One of these is placed on each side of the spine and retained by two connecting arches of T iron. There are rings for the breast strap and crupper to hook on and these only come into play in steep ground. The girth hooks on to the saddle on the off side and is drawn tight on the near by a rope 6 feet long. In G. O., 23rd August 1882, No. 4502 of Madras, Sanderson's Elephant Equipment is dealt with in detail—Part I,

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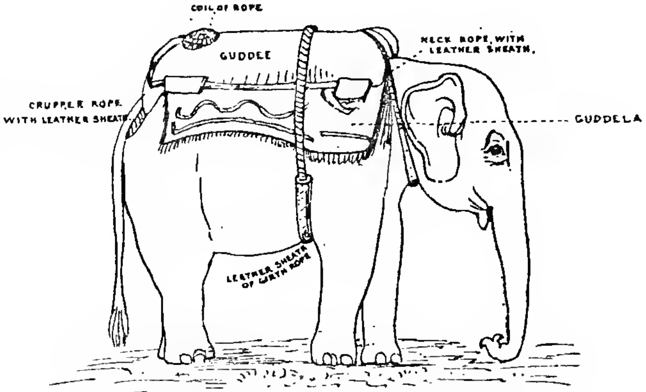
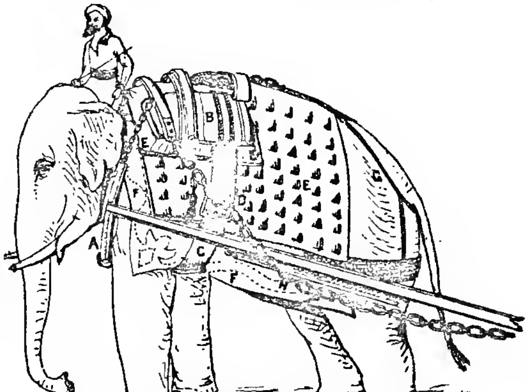
* *Vide* his paper in Journal of the United Service Institution of India—July 1880.



OLD PATTERN BENGAL BAGGAGE GEAR.
(AFTER SANDERSON.)



A. Thick hempen rope, padded and bound with leather.
B. Saddle of wood, covered with a plate of sheet iron.
C. Girth and breeching of white cotton rope sewn together.
D. Iron plate and staple.
E. Thick cotton pads.
F. Leather strapping to ditto.
G. Crupper, white cotton rope.
H. Chain trace.

SHAFT ELEPHANT OF HEAVY FIELD BATTERY GUN.
(FROM THE ARTILLERY MANUAL.)

PLATE, 3.

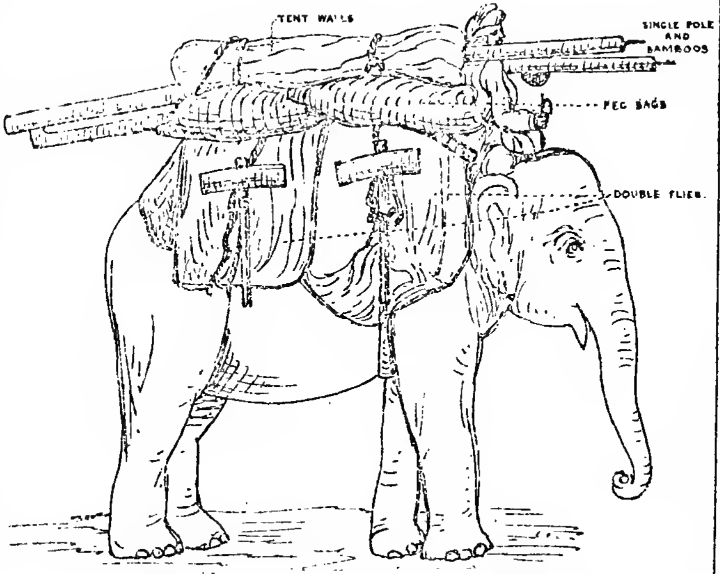
ALEX. BALREN, LITHOG. MADRAS. [illegible]

describes the present gear and its defects, of which the principal are injury to the back from pressure of the posterior cross pad of the *guddee*, which under superincumbent weight becomes almost as hard as wood—also the fact that "in going down hill the gear moves forward, because, the girth, breast rope, and crupper being in one, a pull at any point takes up the slack elsewhere, the hind cross pad then mounts the spine and causes pressure." A saddle tree is objectionable on several grounds—the *improved* equipment is characterized by freeing the spine from pressure and heating, by cutting away the *guddela* and *guddee* along it, unstuffing the rear cross pad, and covering the opening along the spine by a fender or load guard. The forward cross pad is retained over the withers with a view to giving a maximum extent of bearing surface. The longitudinal opening in the guddela and guddee are prevented from gaping by cross bands. The saddle or load guard consists of 3 arches of T iron united by four longitudinal bars, hollow but with short solid cores and nuts at their ends. The upper bars carry two revolving bobbins for the girth. Four rings at the corners receive the breast and crupper ropes. The lower two bars are each to be wrapped with rope to increase the bearing on the pad and a netting of rope should be stretched between the top bars. The girth is so arranged as to be re-adjustable on the march and capable of prompt division if a laden animal gets into difficulties. The neck rope and crupper are quite independent and come-at-able. The crupper is covered with a bent piece of galvanized pipe.

Part II, gives instructions for using Sanderson's baggage gear. The disadvantages of extra weight and increased cost are more than covered by the advantages. Its inventor claims for this saddle that it is beneficial because no saddle cloth is required and the spine remains unpressed upon for its whole length, the load resting upon the upper part of the ribs. It is much less cumbersome than the old arrangement and less liable to be enormously increased in weight by absorbing moisture in wet weather. Also the girths, crupper, and breast strap can be tightened without removal of the load—the latter is more stable and less liable to displacement. Nor is exact equiposition of the load necessary as on the old pad, thus the improved saddle is much better, especially in hilly countries. Foot boards can be attached so as

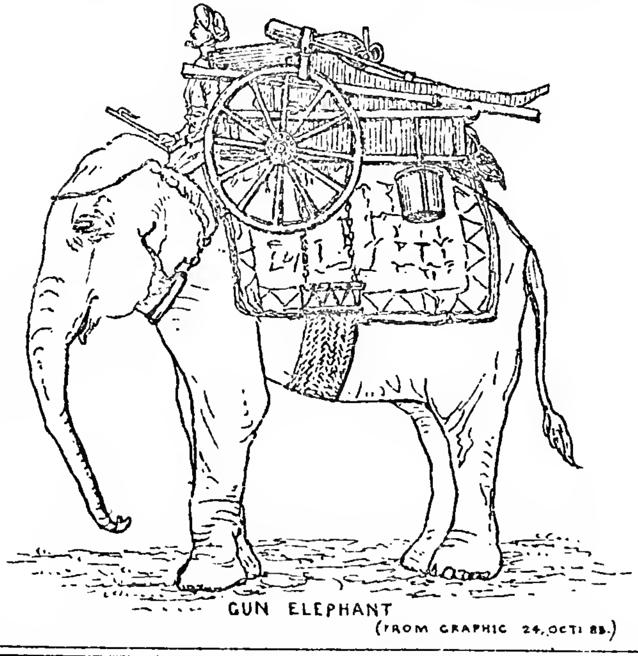
to render it useful for riding purposes or a gun cradle fitted on it, available also for mortars and carriages—undoubtedly this saddle is a great improvement on all others and we see that the New Code allows use of an "iron saddle" in lieu of the neem guddi. Gilchrist suggested as an improvement on the Hoonsoor method of equipment that the gunny used be tanned with the bark of Cassia Auriculata and that for the rope, which although sheathed with leather frequently causes galls, be substituted a wide (12-14 inches) belly-band of gunny stitched to the numdah on the off-side but laced on the near. Also a breeching connected in front with the lower angle of the numdah behind, from which also a band should run to the lowest part of the girth which it would prevent puckering forwards. Also a breast band kept in position each side by a rope from the withers. The load to be attached by ropes passing through eyelet holes in the lower edge of the numnah.

In all cases the pad must be of full size and well stuffed, and its stuffing regularly renewed and constantly seen to for it is very liable to get rotten, especially in wet weather (when the skin is peculiarly liable to chafe), and so to prove a fertile source of galls. The pad must be fastened on firmly and in the proper way. It must, like the inside of a horse's saddle, be kept soft, clean, and dry—if left on when thoroughly saturated with perspiration (and without provision for a free current of air along the back) it softens and relaxes the skin, "draws" it as the process is popularly termed, and so renders it liable to gall. Hurried, careless packing must be avoided by order, system, and strict supervision, in so far as circumstances will allow. The *load* must be well and evenly divided over the back (avoiding all pressure on the spine) and so arranged that it may not, by its centre of gravity being too high, upset the animal, or by swaying too freely produce galls. Finally it must be firmly and tightly fixed so that it may not loosen and shift, and all parts liable to gall may before work be freely dressed with ghee. All parts of the equipment must be kept in good order the ropes especially being kept soft and pliable. The ropes and other fastenings must be tightened after the animal has gone a short distance on the road for they invariably loosen somewhat with work. And advantage must be taken of the halt to see whether the animal is



PART OF EUROPEAN PRIVATE TENTS ON ELEPHANT.

No 1, LOAD (AFTER HAYTER & KELLY)



GUN ELEPHANT

(FROM GRAPHIC 24, OCT. 85.)

PLATE, 4. ALEX: BARREN, LITHOG. MADRAS, 1885.

becoming in any way galled or chafed and to devise measures for removing any injurious influence which is found to be at work by means of pads, stuffing, bandaging, &c.

The *old pattern harness for the elephants of Heavy Field Batteries,* drawing 18-pounder guns and 18″ howitzers, consists of :—The large pad which completely covers the animal from the withers coming well on the quarters and down both sides low enough to prevent the skin from being chafed by either the shaft or draft chains; over this large pad is a smaller one to protect the back, and over it again a very thick pad stuffed with straw on which the saddle is placed. The saddle (the arches of which should be wide, so as not to gall the shoulders with its front points) is used only as the means whereby the girths can be attached, for the elephant pulls from the girth by means of a hook attached to a plate on the girth to which the draught chain and shaft chain are hooked; then there are the breast piece and crupper attached to the saddle to prevent it shifting forward or backward; the back-bands for holding up the shafts; the breechings which hook on to the shafts and are used for backing a gun down a slope, and the stirrups made of rope only for the drivers feet to rest on. The harness of elephant both shaft and leader weighs about 4 cwt.—the former has to carry over 2 cwt. as the weight of shafts, (*Handbook for Field Service, 1867*). Each gun with its carriage and limber weighs about 83½ cwt., each Howitzer 66 cwt.

The *new pattern harness* differs only in some minor improvements from that just described.

The 9-pounder Batteries in Afghanistan in 1879 mustered 22 elephants each, the guns, carriages, limbers, and ammunition boxes were carried in cradles resting on thick pads. The cradle for the gun supported it by an arch at the breech and one at the muzzle (which points to the rear). It is found that the gudeelahs become very heavy when wet, and retain the sweat and keep the animal's back moist, being liable to cause galls. 7-pounder (200 lbs.) guns also are carried on elephants. A squad of 12 men can dismount gun and carriage, put them together and fire a round under four minutes. The elephants must kneel on pads or soft ground otherwise they are liable to jump up at a critical moment (Handbook for Field Service, Vol. I).

We are indebted to Slymm's work for the following information

as to the *gear used in British Burma for weight dragging,* which is entirely a native production. The dragging band is made of bark as being the cheapest material and always procurable. The saddle is in the form of two X connected together with cross sticks under which hides are placed and sometimes pads, but still the weight of the log which is being drawn causes the saddle to squeeze the back. He suggests as a useful modification that a saddle tree to fit the back be used over pads, also he recommends plaits for tying the saddle and hides instead of ropes.

The spear used by the elephant drivers is called *Ankuss, Hendoor Kookee,* or *Guz-baz.* The Guz-baz is a heavy goad of iron, but the Kookee, a light iron hook fitted horizontally on a stick 2 feet long, suffices for ordinary purposes, it is often resorted to most cruelly as we shall have to note hereafter when treating of diseases of the head.* It should be applied only behind the ear. A jhool of some thickness is most valuable as a protector from cold at nights and from heat during the day—sometimes the jhool is worn over the equipment, under the load. In the rainy season it is very necessary and is to be covered with a paulin while the rain is falling (Para. 1788, C. C. of 1882). One spare elephant in ten will be found sufficient in the performance of ordinary duties.

In accordance with Para. 1681, C. Code of 1882, a descriptive register of all Government Elephants is to be kept at every station showing their names, age, sex, height, blemishes, temper, tusks, value, and when and whence originally obtained.

The *art of elephant driving* is decidedly a speciality—many of the movements of the animal which seem to be spontaneous are the result of scarcely perceptible hints from the driver, who occupies a special seat on a cloth above the neck supporting himself by two rope stirrups, *Kellawas.* Sanderson informs us that the so-called "decoy" elephants act entirely under the command of their riders. He also gives a description of the method of training at present adopted :—"The new elephants are first tied between two trees, and are rubbed down by a number of men

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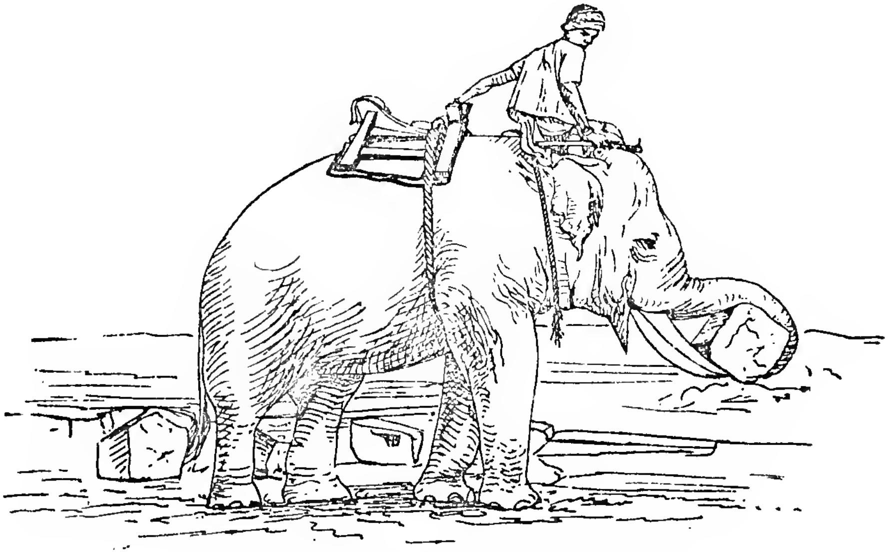
* In animals which are apt to run away either as a vice or frightened by jungle fires (which sound like file firing), the *Andoos,* an iron fetter of 3 joints with spikes on the inside of it, may be put on foreleg; a rope runs from it which should be held by the mahout.



BURMESE ELEPHANT MOVING LOGS.
(FROM A PHOTOGRAPH.)

PLATE, 5.

ALEX: BARREN; LITHOG: MADRAS. 1885

with long bamboos, to the accompanyment of the most extravagant eulogies of the animal, sung and shouted at it at the top of their voices. The animal of course lashes out furiously at first, but in a few days it ceases to act on the offensive, or as natives say "shurum lugta hai" (It becomes ashamed of itself). Ropes are now tied round its body, and it is mounted at its picket for several days. It is then taken out for exercise secured between two tame elephants. The ropes still remain round its body to enable the mahout to hold on should the elephant try to shake him off. A man precedes it with a spear to teach it to halt when ordered to do so; whilst as the tame elephants wheel to the right or left the mahout presses its neck with his knees, and taps it on the head with a small stick, to train it to turn in the required direction. To teach an elephant to kneel it is taken into water about 5 feet deep when the sun is hot, and upon being pricked on the back with a pointed stick it soon lies down, partly to avoid the pain, and partly from inclination for a bath. By taking it into shallower water daily, it is soon taught to kneel even on land. Elephants are taught to pick up anything from the ground by a rope with a piece of wood attached to it being dangled over their foreheads, near to the ground. The wood strikes against their trunk and forefeet and to avoid the discomfort the elephant soon takes it in its trunk and carries it. It eventually learns to do this without a rope being attached to the object." The process adopted in Ceylon is similar even to minute details. Tennent in describing it says that those Elephants which are most violent at first are generally the most effectually and early subdued—the sullen and morose are rarely to be trusted in after life. Those with a thin trunk and flabby ears are the most vicious and troublesome to tame and the most worthless when tamed. Lieut. Johnstone states that it is an excellent plan to scratch newly captured elephants with *fasces* of split bamboo, it makes them docile because they enjoy such treatment very much. Training at the Depôt lasts 2 months, and in 6 months' time the animals are fit for *Sawari* occasionally, but it is a fatal mistake to work them until after the second rainy season. The immense power of the animal renders it a fortunate thing that the best training can be carried out by the judicious giving of rewards, such as spice-balls and other tit-bits or fining offenders their

allowance of jaggery or sugarcane. Although the elephant is naturally of a mild and even timid nature he may be trained to exhibitions of ferocity and cruelty against men or other animals and even against other elephants. The state executions in Ceylon, and often in other parts of India, were performed by elephants.

An elephant enraged is a fearful object; his bellowings are terrific. He charges his enemy with resistless force, seizes him with his trunk, and dashes him against the ground, tramples him under foot, or crushes him beneath the knees, sometimes endeavouring to transfix him with the strong and pointed tusks, although this is a matter of difficulty on account of their direction which ill adapts them as organs of offence. When less excited, he has been known to hurl stones and other such missiles at the object of his dislike, and in opposing one another, elephants, watching their opportunity, charge and upset the enemy on his side. They have a curious dislike for small animals, such as dogs, and in an encampment this dislike ought to be respected. Tennent attributes this to fear lest the dog should attack the feet, organs of which the elephant is most careful. It is well known to be dangerous to encounter elephants by night, for they have a most acute power of smell, and hear with facility. They make sounds differing under different circumstances, indicative of rage, apprehension, satisfaction, and other feelings, and the mahouts learn to discriminate between these.

One of the few vices of elephants is "bolting"—generally the result of fear. Sometimes blind-folding suffices to check the flight but Hood urges the advisability of putting on the hind leg of an elephant liable to bolt a Bhundhun, the other end of which should be lightly attached to the guddee, so that in the event of the animal trying to rush off into the jungle the end of the chain can be easily disengaged and thrown down on the ground when it will lap round some tree or stump and arrest the flight.

INTRODUCTION PART III.

ON THE ELEPHANT AS AN ANIMAL OF TRANSPORT.

The value of any animal for army transport purposes depends upon a number of considerations as to his qualities, mental, moral, physical, and vital, and consequently is not to be decided offhand in a mathematical and commercial manner, although exact calculation and economics give us a basis upon which to work. In the first place, the normal *load* of a full-sized elephant is 15 maunds—on service it may be estimated at 8—10 maunds (say 800 lbs.). That of the pack mule and bullock is 200 lbs. (say for service 160 lbs.). That for camels is four maunds (say 240 lbs. for service). That for small mules, ponies, and asses about 100 lbs. Thus we conclude that on service the loads are proportionately.

Pony, ass, or small mule	:	Elephant	: : 1 : 8.
Pack mule or bullock	:	do	: : 1 : 5.
Camel	:	do	: : 1 : $3\frac{1}{3}$.

The number of attendants required (according to Colonel MacGregor) is camels, mules, and ponies, 1 man to 3.

Bullocks ... . 1 „ „ 5.

and we have seen that the allowance for

Elephants is ... ... 2 men to 1.

Therefore by use of Elephants instead of Ponies there is a saving in attendants in proportion to load carried at the rate of 2 : $2\frac{2}{3}$, but in other animals there is a loss, thus Camels 2 : 1, Pack mules 2 : $1\frac{2}{3}$, Pack bullocks 2 : 1.

Thus elephants require more attendants than most other transport animals provided they be allowed two per head. This probably would not be the case on service where the fodder would be supplied by the Commissariat and thus the grass-cutter not be required. Again it must be remembered that Col. MacGregor's estimate is contrary to the conclusions deduced from the Abyssinian expedition where it was found that there should be one attendant to each pack animal.

All transport animals require skilled attendants. In Abyssinia it was found necessary to wait until Punjabi Muleteers had been imported to replace the useless non-descripts who had been collected for charge of the mules, before the transport could be organized. Thus although the Mahouts must be experienced men this is no drawback to the relative value of elephants for transport. Probably there are proportionately as many skilled Mahouts

available as there are Serwans or Muleteers. Of course the loss by desertion, sickness, or death of a Mahout would be more serious than that of a camel or mule driver.

We must next deal with the *relative mobility* of elephants. As a matter of fact they will do ordinary or even forced marches with ease, moving 3-3½ miles per hour and they are capable of doing this for 10 or 12 hours at a stretch. They can do with little sleep, their limbs are specially constructed for long slow work, and for rest in the standing position. Endurance, capability of forced marches, and a high daily average rate of progress may be put down in favour of the elephant and he may be relied upon to keep up with an ordinary army or baggage train. Havelock in marching to the relief of Cawnpore heard that the rebels were assembling at Futtehpur to obstruct his advance, he sent 150 of the 5th Fusiliers *in haste* on elephants to attack them.

Sanderson has shown that his Department is able to supply as many elephants as are required at present and in the event of even considerable increase in requirements would be able to meet the demand. But the question of *procurability* can not thus readily be dismissed. In writing on the Looshai Expedition, Col. Roberts (now General Sir F. Roberts) has shown that out of 157 elephants told off for the left column, 51 were incapacitated by the journey to the base of operations. This reduction in numbers by one-third is very serious, although perhaps it was advantageous to the column since "survival of the fittest" left only the most useful animals available. It seems too, that Koonkies, "trained decoy elephants which are not supposed to be used for baggage purposes and are quite unable to carry any but the lightest loads," also newly captured elephants and zemindaree animals, many of them quite untrained, constituted about three-fifths of the elephants supplied; this was in 1871-2, Mr. Sanderson wrote ten years later. Although elephants can be transported by rail it is certain they cannot be moved with such facility as the smaller pack animals, thus the numbers of them available for any expedition are limited. We shall show that, in satisfactory accordance with this, the purposes for which elephants can be used in army transport also are limited. Thus we can conclude "*we have evidence to show that elephants for transport can be supplied, with equipment and attendants, in sufficient numbers to meet ordinary requirements for active service*". Dealing now with the question of fodder we

must first enquire whether the elephant can be fed economically and with facility on service. We have the ascertained facts to work on, that in almost every expedition in which they have been utilized some of these animals have died directly from starvation and others from the effects of malnutrition. Also that even in times of peace many suffer from under feeding. Cost of food sinks into insignificance during operations of war, the necessary amounts must be procured at any expense if possible. We will not deal with the question of actual money expenditure, which will vary with the locality and according as war prices are permitted or forbidden by the authorities. In most countries the great bulk of fodder required for elephants is not procurable, the small amounts of local supplies requiring to be very largely supplemented from the base. An elephant's ration of bhoosa for work on service may be put at 200 lbs. per diem, deduct for local supplies of grass, leaves, boughs, &c., 50 lbs., then 150 lbs. per diem per elephant remains to be supplied by the Commissariat. This would suffice for double the equivalent of donkeys, pack bullocks, camels, or mules. The grain rations of the different animals in proportion to their carrying power may be considered practically equal. Therefore *the fodder bulk requisite is a very decided objection to the use of elephants on service;* an objection which increases with their distance from the base of operations. With regard to the power of obtaining food for himself, the elephant requires wide range and a considerable time for feeding, conditions seldom obtainable on service. According to present methods a great deal of care is required in preparation of his food and when ready it is of a nature to prove too great a temptation for a hungry cattle attendant. This too is liable to increase the number of starved elephants with a force.

On the march if 400 elephants occupy a mile, an equivalent number of camels will occupy three miles, and of mules or ponies six miles. Thus *elephants in a convoy are economical in the matter of guards and space.* They are more conspicuous than most other kinds of transport animals and their loss is relatively more serious.

However, the value of the elephant is seriously reduced by his non-adaptability to draught. If put in harness he at once loses much of the relative advantage his weight, size, and strength give him. It is here the bullock and the mule have the great advantage. A mule or bullock in a cart is for transport purposes, as

far as load is concerned, the equal of an elephant, with the incalculable advantages of requiring less food, fewer attendants, and less general attention—but with the disadvantage of being limited to roads fit for wheeled traffic. *The elephant is available for draught only when severe work is to be done for a short time,* consequently it is an advantage to have equipped elephants with any force having guns or a heavily laden baggage or siege train. In a sandy country when the bullocks refuse to move he will draw a heavy weight faster even that horses, in crossing muddy or sandy beds of rivers, and in narrow ravines, where there is not room for a team, his great strength renders him useful. It is a mistake to suppose that the elephant cannot work in a hilly country. As a matter of fact he has done good service both among mountains and on the flat, in thick jungle country and on open maidan. This is only what we might expect from a knowledge of his geographical range. Tennent records the discovery of a spore of elephant on a high mountain peak in Ceylon. However, it must be remembered that some elephants are better adapted than others for work in a country of special physical conformation, plain elephants for plains, hill elephants for hills. Continuous work especially in draught over hard roads or rocky ground is apt to cause sore feet—which, however, is especially liable to result when the animals are used with undried feet on hard dry ground. Stony ground proves trying to laden, and especially overloaded, elephants, who stumble and may fall or bruise their feet severely. An unladen elephant will pass without accident over very rough ground.

The elephant cannot be objected to on the ground of want of versatility—he can do work in more ways than most other animals and with an amount of intelligence, or at any rate methodical performance, which is most admirable and valuable. But the transport work for which he is most useful, the carriage of large tents, and other nondivisible bulky and weighty articles, is becoming of less importance now than previously, and *it cannot be doubted that as a general transport animal the elephant has " seen his day."* He does not stand climatic change well, being seriously affected both by cold and heat if they be extreme. Although an inhabitant of the tropics and naturally nocturnal in his habits, yet when domesticated he requires careful protection from the sun during day and from cold in the night. Although he actually

has received but little European supervision, he requires to be carefully tended, for he cannot be considered a hardy animal like the mule or the ass. He is apt when neglected to suffer from sore feet, and galls of various kinds, and is liable to several epizootics or rather panzootics, such as Anthrax, Foot and Mouth Disease, and Variola. To the male there is the physiological objection that he is liable to the periodical sexual furor known as musthee. Thus elephants are no exception to the rule, as determined from Abyssinian experience, that Transport animals require constant veterinary supervision, and there should be an adequate veterinary establishment with each Division of Transport. *The amount of care required in the ordinary management of these animals is not greater than should be given to all those other species on which the value of a Transport service depends.* The elephant, however, has hitherto not only shared in the general neglect, but, through diffidence on the part of Europeans, due to their ignorance of details of his management, has, both in health and disease, been left entirely in the hands of natives. I. V. S. Oliphant in his valuable *Report of Operations in the Kuram Valley*, pertinently says "The native driver or mahout appears to reign pretty nearly supereme in the management of these useful and valuable animals, and I think it a pity that means are not taken by Europeans to attain more knowledge of their habits and diseases." That elephants are incapacitated on service by sore feet and sore backs is due to want of adequate veterinary supervision of transport–indeed, it may be said, to want of supervision by officers of any kind, so few are posted to such an important duty. The habits of the elephant are very simple, but strange to say are not generally known, most popular ideas about him being sentimental and fictitious. *His mental and moral qualities are in the main such as are suited to render him useful as a working animal*—he is easy to train (especially by kindness), will readily repeat any work he has been shown how to do, and seems in many cases to work with a will—he is patient under labour and very tractable—indeed, if we are to believe some people, he is a big, goodnatured, pliable *fool*! He has very little courage, for although at times he will fight well, against other elephants or tigers for instance, he is somewhat deficient in pluck as a rule, bolts from the sound of fire arms, and has been put to route even by such a small animal as a dog. Indeed he objects to most small animals—dogs, pigs,

and such like—and is said to have an unconquerable dislike for poultry. He is apt to be boisterously playful at times and by a sudden broadside charge at a laden elephant to send him sprawling on the ground.

We may state in SUMMARY.

I. The elephant as an actual weight bearer is most valuable.

II. He is very difficult to feed, therefore, but few can be allowed to the Front on service.

III. But a few are very useful there to assist guns and other heavy draught over awkward places—whether sandy, muddy, or narrow.

IV. In siege trains, for slow draught movement of heavy guns, for carriage of scaling ladders, &c., &c., elephants legitimately find a place.

V. At the Base, and along the line of communications, where they can easily feed and are not exposed to attack or capture, elephants are a most useful means for the transport of heavy baggage, stores, and munitions of war. In this respect they are an excellent substitute for wheeled transport if roads be impracticable for the latter. But they cannot advantageously replace carts and waggons or Traction Engines when the roads are fit for draught.

VI. The spread of Railways and metalled roads lessens the need for Elephant Transport—but in unopened jungly country the elephant is invaluable for Commissariat purposes. Thus *wherever there is a want of good roads from the base the Elephant finds his proper place as an animal of Transport*, he is there more useful than any other animal, and will to an important extent compensate for the impracticability of wheeled transport.

VII. To Engineers the elephant proves most useful for shifting heavy guns, for moving heavy beams, and other weighty articles, in throwing down walls and in various other ways.

VIII. Once the elephant acted the part of Artillery in War—breaking up compact masses of Infantry at once by the weight of its charge and by the dread its appearance gave rise to. It is now used at the front for artillery purposes only in carrying small guns, or in drawing those of Heavy Field Batteries.

PART IV: THE PATHOLOGY OF THE ELEPHANT.

CHAPTER I: INTRODUCTION.

General Considerations: The study of diseases of any animal passes through phases of development. At first those people who have charge of the patient in health deal with him under disease, guided only by tradition and individual experience. This empirical method generally does more harm than good; it thwarts the reparative efforts of nature; it ignores sanitation and prophylaxis, and it tends to the multiplication of Recipes. Next, the importance of the subject attracts the attention of some regularly educated medical men, who throw some light on the pathology of affections, make *post-mortem* examinations, and combat the use of charms and potions in treatment; but they have not the *special* knowledge of Natural History, Anatomy, Physiology, and Therapeutics necessary to guide them in treatment. So the practical handling of disease remains *in statû quô.* Finally, scientific and practical dealing with diseases of the animal is undertaken on the basis of accurate observation, appreciation of previous work, and knowledge of scientific methods. Our knowledge of the diseases of the horse long ago emerged from the second stage, and is now a true and well established branch of science. Of the ox we know less, but our knowledge of his diseases has been systematised, and we are now making rapid strides on true lines of progress. By this series of papers I wish to enter stage three of pathology of the Elephant and to give a sound basis for future advancement, a *point d'appui* for future efforts. I shall show that although we know something about the symptoms of diseases of Elephants, such knowledge is marked by a want of accuracy and exactness; that we have much to learn about respiratory sounds, pulse, chemical composition of the body fluids, and internal temperature; also it is evident that the symptomatology of this important animal requires to be worked up with care. There can be no doubt now that the diseases of elephants are as numerous, complex, and amenable to treatment as those of other animals, but until their study is made on a

scientific basis, the management of elephants under disease must remain somewhat empirical, and the man best acquainted with the manners and habits of the animal will have the advantage. "The diseases of elephants are little understood by Europeans; and a knowledge of their treatment, with few exceptions, is confined to half a dozen or so old Jemadars in the service in the Commissariat Department. Some of these men are acquainted with remedies that will effectually cure the worst forms of disease elephants are liable to, but the ingredients of the medicines in most instances are very expensive. Their skill, therefore, is seldom tested, as beyond a few *annas* per month, no allowance is made for medicines to sick elephants." (Hood) The little that has been done in this direction is eclipsed by the large amount of work that remains to be done. The patients are very valuable, and mostly belong to the Government; *it therefore is incumbent upon the authorities to do their duty, and make arrangements for the scientific and systematic study of the diseases of the elephant.* The infrequency of remains of dead elephants in their native wilds has been commented upon, and therefore it has been urged there should be no necessity for a separate study of elephant pathology. It is probable that internal parasites prove troublesome to the wild elephant, and that insects and other partial ectozoa torment him; nevertheless, the infrequency of disease in him is attributable to the simplicity of his life-conditions. But we take elephants from their native wilds, and submit them to conditions of domestication without those hereditary adaptations to the domesticated state which we find in most of our other beasts of burden; that the effect of this is not a fearful mortality is due to their large size and great value, which to an extent protects them from cruelty, and from being housed in ill-ventilated stables. It also ensures a reasonable amount of attention being paid to them, but, nevertheless, the death roll of captured elephants is high.

There is an idea very prevalent that diseases of the elephant are in most cases not detectable until the animal is about to die and also that his disease-resisting power is small. As a matter of fact the disease is not detected earlier because we are generally ignorant of the signs of deviation from health, we do not resort to exact and nice means of diagnosis, and the management of elephants is generally left entirely to natives. Certainly the domesticated

elephant has but little disease-resisting power, as compared with the horse for instance, but cases of disease in him are not treated early, they are left to run their course until matters are desperate, and then, only too often, treated with drastic and debilitating agents where the system especially requires support. We speak, too, of want of disease-resisting power of the camel and the sheep, because we know very little, comparatively, about their diseases.

Once sick, an elephant is, of all animals, the most difficult to cure, and, I may say, is the least understood of any in the domesticated state. The diseases they are liable to, however, mainly follow on *loss of condition,* and it is most unusual to find an elephant ailing when in proper form."—(Hood).

"The *general signs of an elephant being ill* are langour, want of appetite, and want of sleep. The eyes become watery and contracted, the colour of the mucous membrane or lining of the mouth and tongue loses its rich pink tint, and becomes either whitish or very red with black on the palate. The light spots on the head and trunk lose their healthy appearance. The pulsation is in many instances 90 or 100 in a minute; the animal becomes very thin, and the skin gets a greyish, dirty appearance." (Slym). A dilated pupil, ochre colour of the white parts of the skin, excessive brightness and clearness of the eye, absence of that incessant motion of tail, trunk, ears, or feet which is seen in the healthy elephant, are signs of something wrong, and when an elephant is in perfect health, if patted smartly with the hand, the hairs penetrate one's fingers and make the flesh tingle. (Hood). With regard to CAUSES of disease, the elephant when properly managed very seldom suffers from disorder. His derangements and injuries are the result of want of care through laziness or indifference, of wilful injury or mismanagement, or of culpable ignorance of the means of preserving health. We shall show that he is not exempt from epizootic and communicable disorders, most of which can be conveyed or transmitted to him by other Transport animals such as bullocks and camels. We shall show that much remains to be determined concerning the exact nature and communicability of these disorders, some of which, by impeding transport operations in Afghanistan, yet proved of value as affording qualified Veterinary Surgeons opportunities of observation, of which they made good use. The bulk of the animal

under consideration has somewhat impeded progress as rendering post-mortem examinations, surgical operations, and medical treatment more difficult than in the smaller animals. It also has impressed the generality of mankind with a dread of enquiry about, and interference with, so formidable and extraordinary an animal. As we have elsewhere said, we believe many observations and records of cases of disease of elephants are stored up in the note books of Army Veterinary Surgeons, who have served or are serving in India, and it is to be hoped these and any official Reports on this subject will be made public. The largeness of the patient has, also, necessarily somewhat magnified the size of surgical implements over the ordinary; but we are of opinion, to an unnecessary degree the bulk and amount of doses and ingredients.

In our chapter on Therapeutics, we shall deal with this question, but here we may remark that in reading Gilchrist's account of mussauls as recommended by the mahouts, we are reminded of the treatment of the horse in England in the time of Gervaise Markham, as given in his "Way to get Wealth," and of the barber surgeons of the middle ages. The processes of preparation are most elaborate; ingredients of the most diverse actions, sometimes numbering eighteen to twenty, are taken, prepared, and compounded with the utmost exactness. Sometimes this can only be done on a holy day, or they require to be buried near the grave of an elephant and left there for a certain time! The receipts can be ascertained only by the greatest pertinacity in enquiry. An important ingredient is disemboweled frogs with their legs cut off! A suspiciously large number of the ingredients mentioned by the mahout are useful for his own curries.

We are told that the use of cathartics in the treatment of diseases of elephants is unknown to the natives, and that their medical theory is, "Treatment must be directed either to increase or decrease the body heat." Their experience has rightly led them to adopt the stimulant plan of treatment in most cases, although Gilchrist, in 1841, introduced free bleeding and the use of cathartics, no matter whether for Zérbád or for Inflammation of the Lungs, and suggested removal of blood to the extent of one to one-and-a-half or two gallons, to be repeated

if necessary. Our experience in the present day is not in favour of depletory measures such as the medical theories of his time led Gilchrist to suggest.

Those who have examined Gilchrist's works on the camel, bullock, and elephant, will admire the energy he brought to his task, his zeal in extracting practical information from native sources, and his boldness in taking on himself the duty of pioneer in this unbeaten track of medical science. If he bleeds, purges, and generally depletes in almost every disease, he but follows the current medical system of his time as applied to disorders of lower animals. If he does not launch into scientific dissertations on his subjects, we must remember that our then knowledge of the anatomy and physiology of these animals would not allow him to do so, and he wisely viewed the matter with an essentially practical eye, and wrote for men with very elementary notions on medical science.

It only remains for us to impress on our readers the urgent necessity for experiments and observations on elephant pathology and for record of *all* conclusions arrived at and facts ascertained, each of which has a scientific and practical value.

It will be observed that we have utilized freely all records accessible to us, and, we hope, have not failed to give "honour where honour is due." To GILCHRIST is undoubtedly due the credit of having laid the foundation of the scientific study of elephant pathology.

CHAPTER II: ON THE GENERAL DISEASES OF THE ELEPHANT.

These disorders are among the most important we have to notice, and present some problems for discussion and future solution which have the highest pathological and practical interest. The various derangements which may, roughly, be comprehended under the terms Debility and Asthenia are numerous, frequent, and fatal, but it seems that very much may be done to prevent and cure them. Again, the specific disorders of the Elephant acquire a very great interest and importance in relation to those of other animals. We must lay the more stress upon these latter because until quite recently their epizootic and communicable nature has been ignored and it is only in isolated reports that we find them touched upon.

SECTION 1 :—*Non-Specific Disorders of the Blood.*

ASTHENIA (DEBILITY). There are many causes which may give rise to want of condition in the Elephant. Overwork, underfeeding, the use of coarse indigestible fodder, disorder of internal organs (such as the Liver), Internal parasites all tend to give rise to gradually increasing emaciation, the face and trunk become diminished in size, the templehollows increase much and the patient shows weakness, and listlessness. The skin becomes dry, rusty (often whitish), harsh, rough, and scaly. The hairs fall from those parts where they are found in health. The appetite becomes very capricious and, often, depraved, the animal eats earth, likes to find something cold to play with in the end of his trunk. The fæces are irregular in colour and consistency and generally of an unpleasant odour. These signs of disorder develope gradually and the case is usually chronic. At its latter stages dropsy of different parts of the body sets in, Gilchrist mentions a debility which follows abuse of mercurial preparations. *Œdema of the limbs* is generally described as a distinct affection but it is only one of the symptoms of advanced debility and as such must be treated. In these cases the blood is depraved and contains an excess of water with a deficiency of red corpuscles. *Treatment* of ordinary debility must be by careful regulation of diet and work, and administration of iron and vegetable tonics also occasionally of the stomachic aromatic vegetable products. In cases of dropsy, Diuretics may be given with judgment and exercise whenever possible is very essential.

ZHARBAD (*Zaarbad, Zaarba'hd, Zérbad*) is described as the most formidable disease to which elephants are liable, so it is very important that we should clearly determine what is meant by this term which is one in general use among those who have charge of elephants. It is certain that the term is applied to cases of debility with dropsy. The *Symptoms* are either acute or chronic. In the former case they commence as swelling around the throat which extends down the neck and finally occupies the subcutaneous tissue of the lower part of the chest and belly, the swelling which results is very marked, and when it is tapped a quantity of fluid of a serous nature flows generally with freedom. One or more of these symptoms may be absent. The Asthenia is pro-

tracted, the case sometimes lasting for months and resulting in Paraplegia and death. In chronic cases blind boils (Nunjee) occur beneath the belly especially. They appear like ordinary boils (Russoolee) but do not suppurate, after a time they gradually disappear. They are associated with the general signs of Asthenia. Forsyth applies the term "*Asl*" to acute cases and *Súkhá* to the chronic form.

One very important question suggests itself which careful observation and experiment alone can settle. Is there a specific form of Zérbád? The general opinion is that the disease is sometimes epizootic and communicable, but there is always a tendency when a number of similar cases occur simultaneously to attribute them to contagion. In many outbreaks of Zérbád in certain places the same influences affect a number of animals. Thus when, as is very frequent, it follows recent capture it is no doubt attributable to the debilitating effects of climate and to errors of diet, or when it depends on the presence of parasites a number of these from the same source may have invaded several elephants simultaneously. On the other hand, there are the following considerations which afford a good basis for the belief that one form of the disease has a specific character :—There is sometimes an incipient febrile stage; swellings appear in the positions of the lymphatic glands and extend thence; a fatal result sometimes ensues in 36—48 hours; several animals are often simultaneously affected; and (it is said) the effused fluid may communicate the disease.

Forsyth speaks of troublesome sores resulting and Gilchrist of extensive sloughing and mortification of the external generative apparatus—but we have never observed these complications. Wild animals, even, may be affected especially during the monsoon and cold weather. The disorder is very frequent as a result of the hardships and exigencies of campaigns. *Post-mortem examination* shows enormous dropsical accumulations not only in the subcutaneous areolar tissue, but also in the serous cavities, including that of the spinal cord. Also the depraved state of the blood and other signs characteristic of anæmia are present.

Comparative pathology.—Gilchrist says "with the exception of the swelling of the parotid glands this disease very much resembles, in its symptoms and appearance shown by dissection, the acute form of the disease to which in the Northern Circars the

human being is subject, known by the name of Beri-beri; and it is a singular fact that several of the horses, belonging to the officers of the Goomsoor Force (1837-38), died from an affection the symptoms of which, were very similar to those detailed above as obtaining in the affection of the elephant now under consideration." Now it would not be at all remarkable if horses and men showed signs of Asthenia so as to resemble simple Zérbád so that it is probable that Gilchrist here alludes to the blind boil form as resembling Beri-beri of man. We are not prepared to state whether the two diseases are pathologically equivalent. It seems to be this latter form of Zérbád among wild animals of which "Young Shikarry" writes from the Malay Peninsula; he found expelled from the herd a sick animal which "had only one stumpy discoloured tusk and from head to foot was covered with enormous boils as large as duck's eggs and as thickly spread over him as small-pox covers its victims. Not a square inch of the animal was free from disease, the ears and inside of the mouth and tongue were one mass of running ulcers. The trunk was percolated with holes like a nutmeg grater, whilst the ear hung like dirty rags, seemingly only held together by the dry matter with which they were covered." When he was alive the poor brute made a wretched cracked sound like the yapping of a cur. Another, a large cow, had a big boil on the temple and also one under the fore-legs: some natives attribute this to a guinea worm peculiar to certain districts, others say that it periodically attacks whole herds and causes death of numbers of those going to the coast not of those returning from it: perhaps the sea salt cures any tendency to it. Such extracts as the above effectually do away with the idea that the wild elephant never suffers from disease.

Treatment: The treatment for Zérbád is that recommended for Asthenia; Stimulants, Tonics, and (with judgment) Diuretics. Purgatives and Bleeding as recommended by several authors can only do harm and may account for the great fatality which they set down to the disease. Hood advocates Quinine in drachm doses with Sulphate of Iron in ounce doses, also avoidance of succulent fodder but free use of stimulant Aromatic Cherrai, such as Peepul, Burgot, Bamboo; also a short bath twice a week only, and to keep the animal under cover, but give exercise daily. He omits the Quinine in the dry form of the disease. Sander-

son sensibly suggests "Freedom from unnecessary restraint, liberty to graze at will, or if that be impossible a thorough change of food from dry to green or *vice versâ* according to what the animal has been having when the disease appeared; and protection from all debilitating causes such as exposure to the sun or inclement weather are the best preventatives and restoratives." Slymm's suggestion that the animal be "let loose to graze and find itself the various medicinal vegetables which by instinct it is in the habit of eating" is open to the objection that as we have seen, the disease may in some cases be communicable! "It is an undoubted fact that elephants when sick seek for and devour certain plants and creepers, which at other times they will not care to touch; and if allowed to graze daily in the jungle merely hobbled, will rapidly regain health and condition. Gilchrist tells us that the accumulated serous fluid may be drawn off with a trocar and canula or by puncturing the swelling with a fleam having a blade 1¼ in. wide.

Simple Fever as a disease *per se*, seldom or never occurs, but when dependent on internal Inflammation or preceding a specific disorder it is sometimes severe. *Symptoms:* Animal dull, off feed, thirsty, pulse accelerated, trunk cold and contracted, other extremities and the ears generally cold. The first symptom may be a shivering fit. Urine scanty and reddish in severe cases, in others white and muddy. The animal tries to cool himself by throwing water over the body and in bad cases there is a frothy discharge from the eyes (Gilchrist). *Treatment:* Careful nursing and a laxative dose of medicine followed by diffusible stimulants and diuretics. Bleeding will seldom be required. The diet must be light, cooling, and digestible, and the animal freely supplied with water.

Rheumatism, as might have been anticipated, from the large amount of fibrous tissue entering into the structure of the elephant is a common disorder especially on the march and in the rainy season from exposure to cold and wet. It also is apt to supervene on the animal when heated being taken to water. *Symptoms:* The joints are principally affected, the shoulder being most often involved. The signs are swelling, acute inflammation of a fugitive nature and liable to recur, giving rise to lameness which may shift its seat from one limb to another. *Treatment:*

principally preventative in avoidance of the causes. Comprises local applications of stimulants, anodynes, and fomentations. The benefit of medicines administered internally is doubtful.

SECTION 2. *Specific Disorders of the Blood.*

PLEUROPNEUMONIA ZYMOTICA. Under the name "Epidemic disease of the Lungs" Dr. Macdonald, in the Topographical Report to the Madras Medical Board, has described an outbreak of disease among Elephants on the Tenasserim Coast in 1839, which assumed the epizootic form. He says (but the italics are our own) "It began in Moulmein, *after the mortality ceased among the bullocks,* some time in June. Previous to this elephants throughout the provinces died in immense numbers. *Post-mortem* examinations were made in many of these cases, and, save in two instances, when death appeared to be the result of Peritonitis (in one of which rupture into the abdominal cavity had taken place), all died of disease of the Lungs in various stages of congestion and very frequently suppuration was present. It was observed also that *generally one side of the chest only was affected,* the other lung being fairly healthy. Among those who died in the first outbreak of the disease the lungs were absolutely black throughout their whole structure, more like the spleen, save in its tough membranous intersections, than the lungs. This was so general that in our first examinations it was a matter of doubt what was health and what was disease; but in progress it was ascertained that the healthy lung is of a pale, fleshy, firm, elastic substance while *the diseased structure showed every shade, from the florid appearance of active Inflammation to the black apoplectic condition, this, when cut into, giving forth a frothy purulent exudation.* The animals continued to work till the hour of their death." The italicised passages will be very significant to any reader acquainted with cattle pathology, and it is evidently very important for us to know whether the communicable pleuropenumonia of cattle can affect the elephant? This is not at all improbable, if we consider that elephants and oxen suffer in common from several diseases such as Foot and mouth disease, Anthrax, and Rabies, but these affect also animals of many other species. So we must look a little more carefully into this question of communicability of diseases of oxen to elephants, and then we find that there is a disorder known as EPIZOOTIC

DYSENTERY or MURRAIN which has been observed in Ceylon. The description of it is quoted by Slym as follows:—"The disease is contagious and attacks old as well as young animals; the *symptoms* are of a most distressing nature; want of appetite, the ears drop down, and the hair stands on end, severe griping pains of the stomach and bowels, the animal strikes its head on the ground and rolls about with pain, the dung is mixed with blood and of a very offensive smell, 80 per cent. of the animals die of those which are attacked by this disease." This information is *not* sufficient to enable us to say positively that the elephant suffers from Rinderpest or a disease pathologically equivalent to it. We also are not yet in a position to state whether or no that disease of the Elephant known as "Bloody Urine" is the disease which in the ox is known vulgarly as "Red Water."

ANTHRAX. This terrible and protean disease, so formidable to horses and cattle in India does not spare the elephant. From time to time most serious outbreaks have been recorded but of these, the most detailed has been given by Veterinary Surgeon Frost, then of the R. A. (See Veterinary Journal, Vol. VII., 1879). We venture to give the following summary of facts and observations recorded therein.

V. S. Frost's paper. Post-mortem examination No. 1.—Gelatinous effusion in axillary areolar tissue; anthracoid tumour (6 in. to 8 in.) in region of left parotid; effusion in gastro-splenic omentum; spleen ecchymosed, weight 37½ lbs. (5 lbs. being the normal); under surface of stomach, sub-lumbar and super-penial areolar tissue laden with deposit; 34 to 40 oz. of serum in pericardium, of the colour of diluted venous blood; coagula in heart; gelatinous deposits and ecchymosis of heart.

Symptoms.—23rd. In morning lameness of left legs; refused food (?); no sleep.

24th. Left side apparently better, having been fomented; kept getting up and lying down; refused all food; slept a little that night. Given a cathartic, which acted slightly.

25th. Worse; a large swelling observed behind left ear. Sat on haunches and bit the trunk. Died at 4-30 P.M.

Post-mortem examination No. 2.—Anthrax of bowels, and tumours against penis; blood in vessels fluid; spleen 24 lbs.; liver 61½ lbs.

History of the case : 27th June, 4 P.M., observed to be limping when brought to feeding place from shed ; ate rice and straw, no sleep during night and ate very little ; favoured left hind leg on account of pain.

28th. A swelling between the two hind legs, on right of penis, was observed early this morning. On being taken out of the shed the animal drags the left hind leg, ate charab freely from 9-30 to 10 A.M., passed urine of a whitish colour at 9-45 A.M., and appeared to have no pain in doing so. Passed about a glassful of a dark, watery excrement. At 11-30 A.M. passed, with difficulty, excrement of the usual description, denoting food well digested. At 12-30 P.M. drank a few small buckets of well water, and appeared refreshed. 2 P.M. lively and healthy-looking ; eating charab ; excrement of a healthy nature. 4-30 P.M., during this night no sleep, and the swelling at hind legs grew larger.

29th. Between 8-30 and 9 A.M., animal becoming worse ; the eyes changed from a bright appearance to a black colour ; the tumour greatly enlarged since 6 A.M., and the creature weak, with a watery discharge from both eyes. At 9-10 A.M. it fell down in the shed, suffering from pain and biting the trunk. (Notes by Cattle Sergeant).

Seen by V. S. Frost, on 29th June at 9-30 A.M. Tumours cold and painless on incision ; pulse 68 ; pupils dilated to full ; breathing hurried ; animal down and in great pain. This animal was at first lame of left hind leg. Died at 10-10 A.M.

These are very typical cases of the disorder in question and they serve to elucidate one point which has hitherto perplexed us for they show clearly that the "*Specific Zharbâd is Anthrax.*"

Mr. Frost tells us, "Jolay," or Anthrax, is very common in British Burmah. The soil is retentive, and at the commencement of the monsoon vegetable decomposition is very active. The water is contaminated with every kind of filth, for surface drainage finds its way into the tanks. About thirty elephants daily washed in the tanks at which they were watered ; natives also wash in it, and bullocks defecate in it.

There cannot be the slightest doubt in the mind of any one who enquires carefully into this matter that Anthrax has been the cause of death in very many cases attributed to other influences. Familiar as we are with its manifestations in man and domes-

ticated animals we are aware that it assumes many forms ranging from the carbuncular, most frequently seen in man and the least fatal, to the splenic, intestinal, and pulmonary forms as seen in the ox and horse. The form described by Mr. Frost reminds us of those known as "Blackleg," (technically Inflammatory œdema) in cattle and the carbuncular form combined. Always, as in the former disease, commencing with lameness and leading to death, and as in the latter characterised by local tumours, which most frequently first appear in the lymphatic glands of the limbs and by so doing afford us important information as to how the disease originated. Anthrax is due to fungal organisms entering the body through apparently insignificant wounds either on the surface of the body or of the mucous membrane of the alimentary canal. It is admitted that these parasites cannot enter the body so long as the skin and mucous membranes remain intact and it is highly probable that the glands which are first swollen in an attack are these which lie on the path of the lymph vessels from the wound to the blood. Thus it would seem that in the elephant the gates of entry for Anthrax fungi are generally wounds of the limbs. These need not be large and conspicuous, slight abrasions, foot wounds, even gnat bites might suffice. However sometimes the swelling first appears in the parotid region, then entry probably took place through the abraded mucous membrane of the mouth and pharynx. Let us now look through Gilchrist's work and see what passages *may* allude to Anthrax:

(1). "It would appear that the Elephant is sometimes, though rarely, seized with an epidemic affection of a nature similar to the Budda Azar of the Bullock (Phrenitic cattle plague). The name Budda Bhao is more especially given to this fatal variety of the disease."

(2). Mumps "is a rare affection, but has been known to occasion death after the second or third day"—perhaps this is "Gloss-Anthrax."

(3). The Epizootic Inflammation recorded by Dr. Macdonald may have been pulmonary anthrax, but we are inclimed to doubt whether it was so. 25 elephants are recorded as having died of lung disease at Tonghoo in 1860, the main mortality being in April and May. The outbreak was evidently not *simple* lung disease.

(4). "Ghut Bhao (apoplexy of the lungs) is the name given by the mahawuts to a very fatal affection of the lungs, and one which also shows itself epidemically. It is said, indeed, to be the form in which affections of the lungs generally appear in epidemic visitations. The premonitory symptoms of the invasion of this disease consist in the appearance of hard tumours at the back of the ear, and inside of the top of the foreleg, after a variable period, usually 24 hours. The animal then leaves off feeding and soon shows symptoms of delirium sometimes of a furious kind. It falls down, limbs become convulsed, and dies after an hour or more from the commencement of the disturbance. About the year 1810, I am told that the Government Elephants then stationed at Goa were seized with an epidemic affection of the above kind, with the exception of the appearance of tumours. It proved fatal to every animal attacked" and was evidently Anthrax.

(5). Jolay ka Murz, (termed by Gilchrist, Palsy of the Hind extremities) from the facts that phrensy and high coloured urine are marked symptoms, and that it proves very fatal may in some cases be a form of Anthrax.

(6). As also may the disease described as Bloody urine.

(7). And the blind boils mentioned by Gilchrist possibly are often Anthrax Carbuncles.

The idea conveyed to the reader by the above remarks will probably be, that almost any fatal disorder may be Anthrax. This disease by its different forms certainly resembles many others, but detection of the Anthrax fungi in blood or serum of the affected animal is proof of the true anthracoid nature of the case but want of detection is not always proof to the contrary. These fungi are obtained directly or indirectly from animals of the same or other species for we are not yet acquainted with a species of vertebrated animals to which the disorder cannot be communicated by inoculation. It is probably Anthrax inoculations from elephants of men making post-mortem examinations which are alluded to in para. 1792 of the Commissariat Code which instils the necessity for adopting precautions against in oculation. The prevalence of Anthrax among our cattle and sheep is a standing menace to our elephants whose drinking water and fodder is liable to contamination with the Anthrax

fungi. *Treatment:* must be mainly preventative in carefully avoiding contaminated water and semi-dry tanks made use of by cattle. Also in curing as rapidly as possible even apparently insignificant wounds of the limbs, in complete destruction by cremation of the carcases and excreta of animals which die from this disease. In isolation of diseased animals and carefully sustaining the strength of those which are not yet affected but have been exposed to contamination. Sick animals must be treated with stimulants and tonics. Also such agents as chlorate of potash, carbolic acid, and sulphite of soda may do some good, and the carbuncles must be freely incised and dressed with oil of turpentine and ammonia. Animals once thoroughly affected seldom recover, but Anthrax runs its course in the elephant more slowly than in any other animal we can think of except man, and thus increases the chance of good results from treatment.

Rabies is apt to follow when an elephant has been bitten by a dog affected with this disorder provided the wounds be not promptly cauterized or excised. Dr. Gilchrist has some cases to record. "A mad dog, about five years ago, appeared in the elephant lines at Hydrabad. It attempted to bite several elephants but was by each driven away. During the night it attacked an elephant when asleep and bit it on the trunk. The bite marks having been distinctly observed next day a little oil was applied but nothing more was done; and nothing particular occurred until a month after the infliction of the bite, when decided symptoms of delirium suddenly supervened. During the first three days the animal took fodder, ratib, and water, but afterwards took nothing. It did not appear to be afraid of water, as it drew it into its trunk and squirted it about, and did not drink any. It continued furious for two days, not allowing even the Mahawut to approach, after which it fell down and died suddenly." Capt. F. H. Hood B. S. C. contributes to the Oriental Sporting Magazine, III. 1870, an article, "In Memoriam; Begum," of which the following is a summary:—She was bitten, a mere scratch, on end of trunk by a pariah in September 1869. Wound cauterized and medicines administered, 10 days of illness, for first three suffered great agony and it was necessary to remove her from the sheds, as she commenced to pull them down. She was tied safely to a tree and soon became most violent. After

first day refused all food and water and towards the evening of the third she fell down, apparently exhausted. On the evening of 4th day with one great convulsive gasp she expired. The earliest symptoms were excessive tremblings of her hind quarters, convulsive twitchings in her trunk and limbs, accompanied with obstinate retention of urine, and an angry and inflamed appearance of the scar on the trunk. A man and bullock which had been bitten by the same dog both died mad, as also did an elephant which probably had been bitten.

We are not informed whether there was method in the madness of these elephants as contrasted with the indiscriminate fury found in phrenitis. In the event of the elephant having been bitten by a mad dog, even after due precautions have been taken, he should be kept *for months* under strict supervision and shackled if any signs of extraordinary behaviour are manifested, and if madness sets in he should be shot. No medicine should be given, for the mahouts remedy, containing Bahg ka gosht (tiger's flesh) and Laul Bunnath (red flannel) are "the former difficult to procure and the latter most difficult to swallow."—(Slymm).

Foot and Mouth Disease, Eczema Epizootica, Kŭtlá was very well described by Gilchrist in 1851 who said it "had all the characters, except that of being contagious, of the affection of the Bullock called Moopaung." We now know that it is the same disease as the contagious Eczema of cattle. Our knowledge of this disorder as affecting the elephant is principally the outcome of observations made during the Afghan War by Veterinary Officers of the Kuram Field Force. I. V. S. Oliphant in his official report mentions it as a severe disease termed by the natives "Bhow," which in one case led to a fatal result from Irritative Fever and in several to the shedding of the hoof slipper. (Vide *Quarterly Journal of Veterinary Science in India*, Vol. I., 1882-3.) *Symptoms*: The disease generally commences with difficulty in feeding, but some fever probably unnoticed, has preceded this. Large blebs, about the size of a Rupee occur in the mouth, and the lining membrane of the trunk is similarly affected, indeed from the manner in which the trunk and mouth are used in feeding and drinking they can scarcely escape mutual contagion! The blebs (commonly called vesicæ) burst or their epithelial wall is torn off them and the bright red sen-

sitive layer of the mucous membrane is exposed. Later the feet become involved, attention is first drawn to them by lameness and some swelling of the soft parts around the outer margin of the hoof slipper. On examination some purulent stinking fluid may be found oozing from under the horn. The change most to be dreaded here is that pus may under run the whole sole and lead to shedding of the hoof slipper. When, however, this casualty occurs the case is not to be given up as hopeless, for so simple is this horny investment of the lower part of the limb that it can be well reproduced in the course of time. The fever subsides and recovery rapidly takes place in uncomplicated cases. *Treatment.* Except the application of astringents locally, the protection of sore feet by a boot, isolation, and disinfection, but little is required. Considering the liability of Inflammation to run to excess in the feet it is advisable to give a laxative. Perhaps the following is the best, Tamarind pulp and common salt of each eight ounces given with the rice. Care will also be necessary to prevent the ulcers of the feet and trunk from becoming the seat of maggots. It must be remembered that Foot and mouth disease is highly contagious and can be communicated to all mammals and birds. It very frequently appears among the Transport Cattle of Indian Armies, and proves a very serious impediment to advance. With care and watchfulness it is not a fatal disease to the elephant but neglected cases prove serious and tedious. Occasionally it is said that, as in the smaller mammals, the eruption invades the mucous membrane of the alimentary canal giving rise to exhausting diarrhœa and death.

VARIOLA ELEPHANTI, usually described as "Small-pox" of the elephant, is probably the form of variolous disease peculiar to the species. We have no evidence that it is small-pox communicated from man nor any other form of animal pox. Much has to be learned about it, but thus much we are sure that sometimes an epizootic occurs among elephants characterized by variolous eruptions generally on head, chest, and trunk. Sometimes the eyes are invaded and opacity of the cornea (even causing blindness) takes place, generally this is purely temporary. This seems to be the disorder alluded in the following extract as "an epidemic disease, corresponding to murrain in cattle (cattle plague) from which wild and tame elephants suffer at long intervals. It at-

tacked the elephants of the Government stud at Dacca, in Bengal, about 30 years ago, and carried off nearly 50 per cent. of a total of upwards of 300. It lasted, with varying virulence, for more than ten years. The animals in best conditions suffered most; only two, both in poor condition, are recorded as having recovered after seizure. The symptoms were: breaking-out and gatherings on the throat and legs, spots on the tongue, and running from the eyes, with the cessation of the flow from the eyes the animals died, usually on the second day after attack. In 1862 a similar epidemic carried off large numbers of elephants in the Chittagong forests, a few years later the herds in the Kàkankoté jungles in Mysore were attacked; but the mortality was not great and the disease soon left" (Thirteen years among the Wild Beasts of India). The description of symptoms is not ample enough for exact diagnosis. The disorder is seldom severe among adults, internal treatment and preventive measures as suggested for Foot and mouth disease may be adopted. The seat and nature of the eruption will enable the observer to readily distinguish between these two disorders.

Having thus indicated the epizootic disorders to which the elephant is liable we must, finally, point out that they are generally communicable from and to other species. That such hygienic preventative measures as modern science suggests are possible and should be rigidly enforced in all cases of communicable diseases of elephants. They are, principally, isolation of affected or suspected animals, disinfection of saddlery and other appointments with destruction of the least valuable. Cremation of litter, carcases, and excreta (especially dung and urine), disinfection of lines, and then, if possible, a change of station for the healthy. It must be remembered that medical and ordinary attendants can convey these diseases, unless great care be exercised. Prevention and repression are better than cure. I have known Bullocks affected with Foot and mouth disease "isolated" by being put among the elephants!

Statistics of Elephant Mortality.

Tennent shows that, out of 240 elephants employed by the Ceylon Government which died in 25 years (1831-56), when the duration of captivity was known it was under one year in about 50 per cent.; of these $\frac{2}{5}$ were females. The following are enumerated as the causes of 34 deaths between 1841 and 1849:—Swellings of Jaws and Abdomen, 9; Cattle Murrain (?), 10; Sore feet, 1; Colds and Inflammation, 6; Diarrhœa, 1; Worms, 1; Diseased liver, 1; injuries from a fall, 1; General debility, 1; unknown causes, 3.

The following tables of the Annual Mortality of Elephants in the British Burmah division from 1860-78 are deduced from those given by FROST.

TABLE I.

YEAR.	1860.			61.			62.			63.			64.			65.		
STATION.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.
Strength.	30	46	..	30	41	..	30	35	..	30	32	..	30	30	..	21	30	..
January ..	..	..	..	..	..	..	..	..	..	2	1	..	..	..	..	..	..	..
February ..	1	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
March ..	7	2	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
April ..	8	11	..	2	1	..	..	..	..	..	..	..	..	1	..	1	..	..
May ..	..	15	..	..	..	..	..	..	..	2	1	..	1	..	..	2	1	..
June ..	..	3	..	4	..	..	1	1	..	..	..	..	..	1	..	..	..	..
July ..	2	1	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..
August ..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..
September ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..
October ..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	..	..
November ..	..	..	..	1	..	..	..	..	..	..	..	..	1	..	..	1	..	..
December ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Total ..	19	32	..	8	1	..	3	1	..	4	3	..	3	2	..	9	2	1
Percentage of sickness (approx) ..	64	70	..	24	2¼	..	10	3	..	13⅓	10	..	10	7	..	43	7	?

YEAR.	66.			67.			68.			69.			70.			71.		
STATION.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.
Strength.	19	31	..	26	34	..	14	35	..	16	34	..	28	31	..	..	31	..
January ..	..	..	..	..	..	..	..	..	..	..	1	..	1	3	1	..	..	1
February ..	1	..	..	..	..	..	..	..	..	..	..	1	..	..	1	..	..	..
March ..	1	1	1	..	..	..	2	..	..	..	..	1	..	..	2	..	..	1
April ..	..	..	..	..	..	1	1	..	1	..	..	1	1	..	1	..	1	..
May ..	1	..	..	1	3	3	..	..	..	..	..	1	..	2	..	..	1	..
June ..	2	..	..	5	..	..	1	..	2	..	..	..	1	..	..	..	3	..
July ..	..	1	..	1	..	..	1	..	1	1	..	..	1	1	..	..	..	..
August ..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..
September ..	..	..	..	..	..	..	1	..	..	..	2	..	..	8	..	..	1	..
October ..	..	..	..	..	..	..	1	..	..	1	..	..	1	..	1	..	..	..
November ..	1	..	..	..	..	1	..	..	..	1	1	..	1	..	..	..	1	..
December ..	..	..	..	..	..	..	..	1	..	..	2	..	1	..	..	..	..	..
Total ..	6	2	1	7	3	6	7	1	4	3	6	4	5	9	6	..	7	2
Percentage of sickness (approx) ..	34	6	?	28	9	?	50	3	?	20	18	?	22	22	?	..	22	..

YEAR.	72.			73.			74.			75.			76.			77.			1878.			Total in 19 years.		
STATION.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.	Rangoon.	Tonghoo.	Thayetmyo.
Strength.	29	23	..	27	29	..	30	27	..	23	52	..	26	57	..	20	42	..	27	4	..	25	33	abt 30
January ..	..	1	..	..	..	..	..	1	1	1	..	..	..	..	..	—	..	..	..	..	..	4	7	3
February ..	..	2	..	1	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1	..	4	4	2
March ..	..	2	..	..	..	1	1	..	1	..	..	..	..	..	..	..	1	..	..	..	..	12	6	7
April ..	..	..	..	..	1	1	2	..	..	..	..	..	..	..	..	..	1	..	..	..	..	15	16	6
May ..	2	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	5	1	..	..	2	10	28	8
June ..	..	..	..	1	..	..	..	..	..	..	..	..	..	1	-1	..	4	1	4	..	1	10	13	5
July ..	..	..	..	..	..	..	4	2	..	1	1	..	..	..	..	..	..	..	1	..	..	12	7	1
August ..	..	..	..	1	..	..	..	..	..	1	..	..	1	..	..	..	..	..	..	..	..	5	1	1
September ..	..	..	..	..	..	..	..	..	..	..	1	..	1	..	..	2	..	..	..	..	..	8	7	..
October ..	..	..	..	1	1	..	..	..	..	1	1	..	..	..	1	1	..	..	..	..	..	8	2	2
November ..	..	..	..	..	..	..	..	..	..	..	3	..	1	1	1	..	1	..	..	..	..	6	7	2
December ..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	1	..	..	..	..	..	1	4	2
Total ..	2	5	..	4	2	3	8	3	2	4	7	..	3	2	4	4	13	2	6	1	3	104	102	38
Percentage of sickness (approx) ..	7	3	..	14	7	..	25	11	..	22	15	..	17	25	?	15	31	?	20	35	..	23	14	10

From this we learn [a] That Rangoon is much more unhealthy for elephants than Tonghoo, and that Station than Thayetmyo.
[b] That March, April, and May are the most fatal; and August the month least so in the year.
[c] That the total loss in the division gives a percentage of 15. Considerably above Sanderson's estimate!
[d] 1860 was a very fatal year, 1861, 1865, 1866, 1867, 1868, 1874 were unhealthy years in Rangoon; 1870, 1871, 1877, and 1878 were rather fatal at Tonghoo; 1867 and 1870 were the worst years at Thayetmyo.
[e] The total number of Elephants lost in the division was 144. Total value about 2 Lacs of Rupees!

Table II.—*Showing reputed causes of death of Elephants—British Burmah Division.*

Year.	1860			1861			1862			1863			1864			1865			1866		
Station.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.
Strength.		46			41		..	35			32			30			30	..		31	..
1. Lung diseases ..		25			..		..	1			..			..			..	..		1	..
2. Heart diseases ..		..			..		..	..			..			..			..	..		..	..
3. Liver diseases ..		..			..		..	..			..			..			..	..		1	..
4. Lung and Heart diseases ..		1			..		..	..			1			..			..	..		..	..
5. Lung and Liver diseases ..		1			..		..	..			..			..			..	..		..	..
6. Bowel diseases ..		..			..		..	..			..			..			..	..		..	1
7. Brain diseases ..		..			..		..	..			..			1			..	..		..	..
8. Sunstroke ..		1			..		..	..			..			1			..	..		..	..
9. Natural Causes ..		..			1		..	..			..			..			1	..		..	..
10. Dropsy (Zerbad) ..		1			..		..	..			1			..			..	1		..	..
11. Debility ..		1			..		..	..			..			..			..	..		..	..
12. Anthrax (Jolay) ..		..			..		..	..			..			..			..	..		..	..
13. Entozoa ..		..			..		..	..			1			..			..	..		..	..
14. Accidental ..		2			..		..	..			..			..			..	..		..	..
15. Unrecorded ..		..			..		..	..			..			..			1	..		..	..
Total ..	19	32		8	1		3	1		4	3		3	2		9	2	1	6	2	1

Year.	1867			1868			1869			1870			1871			1872			1873		
Station.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.
Strength.	25	34	..	14	35	..	16	34	..	28	31	..		31	..	29	23		27	29	..
1. Lung diseases ..	6	..	..	1	..	..	..	2	..	..	5	..		5	..	..	..		..	1	..
2. Heart diseases ..	..	..	..	..	..	..	..	..	..	..	..	..		1	..	..	..		..	..	..
3. Liver diseases ..	..	..	..	..	..	1	1	..	..	..	..	..		..	..	1	1		..	..	..
4. Lung and Heart diseases ..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..		..	..	..
5. Lung and Liver diseases ..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..		..	..	..
6. Bowel diseases ..	..	..	..	2	..	..	..	..	..	1	..	..		..	1	..	..		..	..	..
7. Brain diseases ..	1	..	2	1	1	1	2	4	1	1	1	3		1	1	1	1		2	1	..
8. Sunstroke ..	..	..	..	..	..	..	..	..	..	..	2	..		..	..	..	2		..	..	..
9. Natural Causes ..	..	..	3	..	..	2	..	..	1	..	1	..		..	..	..	..		..	..	..
10. Dropsy (Zerbad) ..	..	..	..	2	..	..	..	..	2	1	..	1		..	..	..	..		1	..	1
11. Debility ..	..	..	..	..	..	..	..	..	..	1	..	..		..	..	..	..		..	..	..
12. Anthrax (Jolay) ..	..	..	..	..	..	..	..	..	..	1	..	..		..	..	..	..		..	..	..
13. Entozoa ..	..	..	..	1	..	..	..	..	..	..	..	..		..	..	..	..		..	..	..
14. Accidental ..	..	..	..	..	1	..	..	..	..	..	..	..		..	..	..	..		..	..	..
15. Unrecorded ..	..	3	..	..	..	..	..	..	..	..	..	2		..	..	..	1		..	..	2
Total ..	7	3	6	7	1	4	3	6	4	5	9	6		7	2	2	5		3	2	3

Year.	1874			1875			1876			1877			1878			Total.			
Station.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.	Rn.	T.	Tt.	Total.
Strength.	30	27		23	52		25	57	..	29	42	..	27	4	.	25	33	30	..
1. Lung diseases ..	1	2	..	2	..		..	..	..	2	1	..	1	..	..	13	43	..	56
2. Heart diseases ..	..	..	..	..	..		..	..	1	..	..	..	..	..	..	1	..	..	1
3. Liver diseases ..	1	..	..	1	..		1	1	..	..	..	..	1	..	..	6	4	1	11
4. Lung and Heart diseases ..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	2	..	2
5. Lung and Liver diseases ..	..	..	..	1	..		..	..	..	..	..	..	..	..	..	1	1	..	2
6. Bowel diseases ..	..	..	..	..	1		1	..	2	1	3	..	..	..	..	5	4	4	13
7. Brain diseases ..	5	1	..	..	..		..	..	..	..	..	..	2	1	2	15	11	10	36
8. Sunstroke ..	..	..	..	..	..		..	..	..	..	5	..	..	..	..	..	12	..	12
9. Natural Causes ..	..	..	..	..	1		..	..	1	..	2	1	..	..	1	..	6	9	15
10. Dropsy (Zerbad) ..	1	..	1	..	1		..	..	..	..	..	..	..	..	..	5	3	7	15
11. Debility ..	..	..	..	..	1		..	..	..	..	..	..	..	..	..	1	2	..	3
12. Anthrax (Jolay) ..	..	..	..	..	..		..	..	..	..	..	..	3	..	..	4	..	..	4
13. Entozoa ..	..	..	..	..	3		..	1	..	..	1	1	..	..	..	1	6	1	8
14. Accidental ..	..	..	..	..	..		1	..	..	..	..	..	..	..	..	1	2	1	4
15. Unrecorded ..	..	..	1	..	..		..	..	..	..	1	..	..	..	..	..	6	5	11
Total ..	8	3	2	4	7		3	2	4	4	13	2	7	1	3	53	102	38	193

Rn.—Rangoon. T.—Tonghoo. Tt.—Thayetmayo. Blank spaces indicate no fairly accurate record. Dots indicate no cases.

CONCLUSIONS.—Brain diseases, Disorders of Lungs, Liver, and Bowels, and Dropsy are reputed the principal causes of death. Probably many of the "Lung" cases were Anthrax [vide text]. This list of diseases is very rough and inexact but is the only one wa have to guide us, except Tennent's which is even more open to objection.

At first sight it will seen that these statistics tend to disprove some of the statements in the text. After careful examination, and making allowance for inaccuracies and inexactitude, I conclude that the reverse is the case. One thing is certainly made very clear by them, that very many Government elephants are lost by disease annually and that this involves a heavy drain on the public purse.

ELEPHANT POISONING

Is sometimes carried out rather extensively by natives whose crops have been destroyed by invasion of herds. A writer in the *Asiatic Researches*, Vol. XV., p. 183, describes how in some parts of Bengal (especially near the wilds of Ramgur) the natives poison elephants by mixing a preparation of the poisonous Nepaul root called *Dakra* in balls of grain and other materials of which the animal is fond. In Cuttack, above fifty years ago, mineral poison was laid for them in the same way and the carcases of eighty were found which had been killed by it.

MERCURIAL POISONING.—The formation of tumours over the body, progressive anæmia, and even disorders of the feet have been attributed to the empirical use of the compounds of mercury in too large quantities. There can be little doubt that nature has provided the elephant with a discriminating instinct by means of which he is able to avoid ingestion of substances of poisonous properties among the numerous and various plants offered him as food. To the disappointment of the traveller, elephants enlarged among apparently beautiful pasture grass will often reject it in favour of less plentiful and much less inviting food. A good mahout in preparing the fodder will reject those substances, which, as experience has shown him, are usually left uneaten by his elephant.

CHAPTER III: ON THE CIRCULATORY SYSTEM.

The most remarkable facts about the Blood Circulatory Apparatus of the Elephant from an anatomical point of view are:—The Heart has two points, its sides being separate towards the apex, this organ very seldom has fat in its grooves, and the blood pours into it from the front of the body by two large vessels instead of a single anterior vena cava. The veins form in the temporal region, about the front of the chest, and in other parts large networks (especially predominant about the bends of joints) and in these the flow of blood is doubtless much retarded while the animal is in a state of repose, and from them it is driven more rapidly when the animal is moving. This anatomical fact is associated with the small development of the

Lymphatic system, and both show that nature has adapted the animal for a somewhat sluggish, but long life—for long continued slow work. The most notable peculiarity of the Elephant's blood, the smallness of its corpuscles (relatively, although, absolutely, they are among the largest nonnucleated corpuscles known) arranges for the limited supply of oxygen for tissue waste. The characteristic features of the circulatory system are juvenile and not highly special—thus the organs which compose it are but little liable to disease. There is not vigour in the system of the Elephant to enable him to withstand serious disorder, so he is a "bad patient," and his disorders assume the asthenic (weak) type and require to be treated in almost every case by means of stimulants. We are not prepared to state the use of two fibrous cords which pass from the back of the pericardium to blend with the elastic tissue covering the front of the Diaphragm. These bands are themselves elastic.

The PULSE, taken at the posterior auricular artery, averages about 49 beats [25-28 in Europe (Colin)] per minute, its indications as to the presence or absence of fever and internal inflammation are fairly reliable. We feel for it at the root of the ear, somewhat behind, but it requires a good deal of practice to be able to take the pulse of an Elephant satisfactorily. The same vessel may be utilized for the abstraction of blood, however this operation is one which will seldom be required for the Elephant, the only cases in which it is admissible being those of Brain disorder (Inflammatory or Apoplectic) or of Inflammation of the Facial Sinuses; in fact it is a useful measure in cases of "Sunstroke" and may then be performed by opening the artery behind the ear with a common abscess lancet. *Phlebotomy*, the opening of a vein, cannot be performed in the neck at the jugular because of the smallness of this vessel as compared with that of most other quadrupeds, the greater part of the blood returning from the head by one much more deeply placed in the neck. There are mechanical difficulties, too, in the way of bleeding—the skin is so thick that it must first be divided and then the wall of the vessel punctured with an abscess lancet. The patient also requires to be secured by fetters; and the vein (generally the large one inside the thigh) raised by a ligature passed round the limb above the seat of operation. The amount of blood to be removed should not be

much, the pulse and general condition of the patient will be our guide.

Wounds of Bloodvessels are to be treated on ordinary surgical principles, such as by pressure, ligature, and application of hot iron to stop the bleeding. In case of emergency continuous cold water affusions are the best means of restraining bleeding, or it may be necessary to pin up the wound; the hæmorrhage is not likely to prove fatal although seriously debilitating in some cases—an exception to this rule is an injury to the Trunk, complete severing of the extremity of which organ leads to speedy death from bleeding, although partial ablation has not the same serious effects (*Vide* a letter by Mr. Sanderson recently published in the *Englishman*, and Sir S. Baker's "Nile Tributaries of Abyssinia"). The arteries and veins of the Trunk are large and run through channels in the organ, the main ones longitudinally and in loose areolar tissue; thus the organ seems somewhat erectile in its structure.

CHAPTER IV: ON THE ALIMENTARY SYSTEM.

The *Lips* are peculiar; the upper one is blended with the nostrils to form that remarkable organ, the Trunk, which at its base on either side below has a thin lip-like expansion. The lower lip is pointed anteriorly being small and rudimentary, forming a mucous channel above for the tongue, which is also small in proportion to the size of the animal. Since the trunk introduces food with precision into the mouth the latter is not large and its roof is quite smooth and free from the ridges running from side to side such as are seen in the Horse and Ox. The Teeth are of two kinds; Tusks and Molars.

The *Tusks* are peculiarly modified incisors, and do not therefore represent the "Tushes" of the horse. They are simple teeth, found only in the upper jaw, generally one on each side, occasionally one only as an irregularity. They are often very small in the male and are then called "Tushes"; they are ordinarily found in the female of the African Elephant only (but in the rudimentary form in all varieties); in the extinct ancestors of the Elephant they attained a maximum of size and curvature. They are embedded in very deep sockets of the premaxillæ (mainly), and have a single pulp cavity extending into each of them for a considerable distance. This fact must be remembered in

CUTTING THE TUSKS, an operation which requires to be performed either when in large animals they grow inconveniently long, cross one another so as to impede the free action of the trunk, or when they split up longitudinally. "The operation is done with a common saw kept continually wet with a trickling stream of water. To find the proper place to cut the tusk measure with a bit of twine the distance from the eye to the insertion of the tusk in the lip, this length measured from the latter point *along the tusk* will give the spot where it should be cut" (Hawkes). This practical rule occasionally proves misleading, for the proportion of tusk to pulp increases with age, and so occasionally the tusk is, especially in young animals, cut off too short—hence Col. Hawkes advises us to "cut off too little rather than too much." By *Fracture of the Tusk* also the pulp may be exposed, and as it is full of vessels and nerves such an injury is very painful and the exposed soft parts bleed freely. They must be, as quickly as possible, covered with some agent which will neither prove too stimulating nor allow access of flies. The latter may very seriously aggravate the case by depositing their eggs which develope into maggots and retard healing by causing irritation. Col. Hawkes' treatment with Dikàmali (Gardenia lucida) Ointment and binding the injured tooth with a cloth dipped in tar is good and scientific; Turpentine Ointment may be used instead but is more stimulating. The growth of the Tusk is by gradual converson of the surface of the pulp into tooth substance which gradually prolongs that already formed. Occasionally a bullet lodges in the tooth pulp entering from behind and in course of time it will by this process of growth become embedded in sold ivory—this is no exception to the general process of tooth growth. Small temporary tusks generally precede the permanent ones and are shed between the first and second year when still very small. The tusks in addition to being powerful organs of offence and defence are useful in various ways: Pringle shows how they are by the wild elephant used as crowbars in uprooting trees the succulent rootlets of which may be consumed as food, they are used as spades for obtaining fleshy underground roots of plants, and cases have been recorded of animals helping a comrade out of a hole by means of the tusks.

Ouchterlony mentions them as useful for "tearing bark off trees, digging from banks the peculiar clay of which cattle are very fond, and prising down bamboos from clumps too thorny for use of the trunk, and for detaching earth and roots from tufts of grass and shrubs." Dragging ropes are sometimes attached to them. Thus any injury to these useful organs is a serious detriment. It is interesting to observe that undoubted *ova are sometimes found deposited on the roots of the tusks* of young wild elephants, within easy reach of the tongue, protected from accidental removal by the ivory having been indented from the action of the corrosive fluid ejected by the female gad fly with and around them. This is an interesting example of instinct in the adult fly causing it to deposit the eggs in that place whence they are most likely to be conveyed into the stomach for development into larvæ. Does Tennent allude to this when he writes "Elephants are said to be afflicted with toothache; their tusks have likewise been found with symptoms of internal perforation by some parasite, and the natives assert that in their agony, these animals have been known to break them off short" and to pick caried molars with a piece of wood!!

THE MOLAR OR GRINDING TEETH of the elephant deviate in a remarkable manner from those of most mammals. They are enormous, very complex in structure, very firmly fixed in the jaw, and special in their mode of replacement. Generally on each side of each jaw two or three teeth may be seen—the front one is small, often loose, and is sometimes shed because the growth of the second gradually cuts off its supply of nutriment by compression of the fangs. This is a natural result of development, but has been termed "*Koochlee*" by the mahouts. The second or main tooth consists of a number of subdivisions, composed of dentine coated by enamel, arranged in a linear series from before backwards. All these are embedded in an enormous amount of cementum, layers of which are between each subdivision and coating every part of the surface except the depressions for the pulp cavities and the table or grinding surface of the tooth. When the organ comes well into wear the table presents a series of enamel edges which vary in shape in the African and Indian species—those of the former being arranged in diamond or lozenge-shaped figures, those of the

latter in oblongs the long sides of which are parallel to one another. Thus the tooth of the African elephant contains fewer subdivisions than that of the Indian. These huge masses of tooth constituents are admirably adapted to act as millstones in grinding down hard vegetable matters, the arrangement of substances of a different degree of hardness on the table secures a constant roughness which gives the firmness of grasp necessary for proper comminution of food. As the animal grows older a succession of teeth takes place from behind resulting from development of the tooth capsule backwards as the jaw lengthens; also in each individual tooth the subdivisions come into wear in turn from front to back, thus each in turn attains a maximum of size and then its fang begins to lengthen, and to become absorbed in consequence of pressure from the sub-division behind, and wear reduces the length of the tooth from the other extremity, so each tooth subdivision has its period of growth and decline. The total arrangement is such as to most thoroughly provide for sufficient tooth material throughout the long period of life allotted to elephants.

Such complex and important organs as the Elephant's molars are naturally liable to disorder. Firstly, *Crusta Petrosa Tumours* are apt to result from excess of the normally enormous amount of this material. They are generally of considerable size and liable to seriously reduce the condition of the animal by interfering with mastication. It is necessary to secure the animal by mean of shackles in a recumbent position, fix the mouth open by means of a wooden gag* and remove the tumour by means of a butcher's or amputating saw. Colonel Hawkes mentions an *irregularity caused by disease of the fang*, abnormal growths on which force the teeth, especially the small front ones, so much out of place that they abrade the inner surface of the cheek and render mastication painful in the extreme. It is evident that in such cases simple sawing off of the projecting portion is not sufficient; we have to deal with tooth ache from diseased fang as well as with inability and impediment to mastication, the displaced portion of tooth must, if possible, be extracted by judicious use of a chisel or pritchel and mallet.

The enormous weight of the Elephant's teeth implies large jaws,

* The gag used by the mahouts has sometimes unnecessary iron spikes in it.

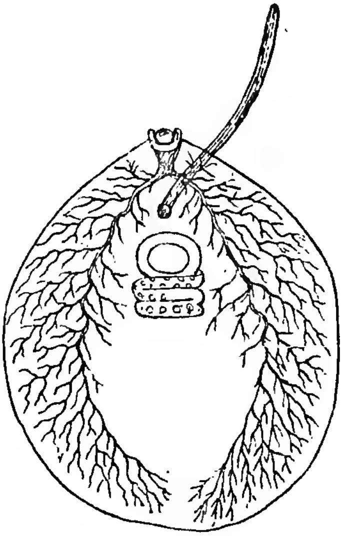
stout jaw muscles, and a very strong ligamentum nuchæ, also a great development of the facial sinuses to lessen the weight of the head by containing much rarified air, and shortness of the neck at the unsupported extremity of which this huge and weighty skull is placed. The elephant's skeleton, only, of all which I have mounted was found to require a special prop for the skull! An elephant in feeding makes use of the tusks and even the fore limbs occasionally in the emergencies of wild life, but usually he simply requires the trunk as an organ of prehension. With this "lithe proboscis" he is enabled to grasp either large things or small. The former he seizes by twisting the trunk more or less round them, and the skin of the posterior surface of the organ is ordinarily transversely corrugated to make the grip firm, with smaller objects he simply closes the hand-like extremity of the organ, and, while seeking a fair trunk-full, he will retain small particles in the end of the organ by slight short sniffings. Thus by the judicious exercise of patience the trunk is able to collect sufficient material to make it worth while for the huge jaws to come into motion, and the immense millstone-like teeth to crush the materials placed between them by the backward flexure of the proboscis. This careful collection of the food by the trunk and its precise direction in suitable quantities into the mouth render injuries to the mouth infrequent. However an INFLAMMATION OF THE CHEEK has been discribed by Slym as "in a more or less degree a common disorder." The animal is off his feed, the cheek is swollen and painful, there is a little fever present, the bowels being torpid. The treatment he recommends is local abstraction of blood by means of leeches, free fomentations, and a cathartic dose consisting of Cassia and Tamarind plups, 2 ounces each, with common salt and gingili oil of each 8 ounces. It is liable to interfere with the condition of the patient.

The *Tongue* is small, and posteriorly, instead of anteriorly, very flexible and highly developed. The *Salivary glands* are small, indeed a doubt exists in the minds of anatomists as to whether there really are any but the small parotids. We, theoretically, would hardly anticipate this anatomical state in a strict vegetarian like the elephant!

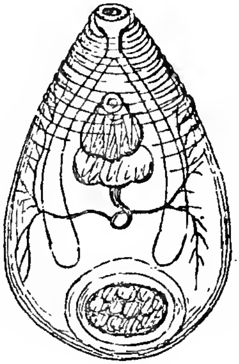
The *Pharynx* exhibits several important peculiarities. It is so arranged that the part commonly described as Isthmus faucium,

between the base of the Tongue and the upper opening of the larynx can be isolated as a special pouch for physiological purposes and is capable of holding a fair amount of fluid, which may possibly be supplemented by gradual regurgitation from the stomach. The trunk introduced through the mouth can, by suction, take up the fluid accumulated in the pharyngeal pouch to be utilized subsequently either for throwing over the surface of the body or for drinking. Dr. Watson has carefully examined, and given theories as to the physiological value of the special anatomical features of the pharynx of the elephant, he says "an elephant can, as the quotations sufficiently prove, withdraw water from his stomach in two ways: first it may be regurgitated directly into the nasal passages by the action of the diaphragm and abdominal muscles [I consider this view open to grave doubt, (J.H.S.)] the soft palate being at the same time depressed to prevent the entrance of water into the mouth. Having in this manner filled the large nasal passages communicating with the trunk, the water contained in them is then forced through the trunk by means of a powerful expiration; or, in the second place, the water may be withdrawn from the cavity of the mouth by means of the trunk inserted into it." We are rather inclined to agree with Miall and Greenwood in considering the pharyngeal pouch as in the main concerned in the formation of the masticated food into pellets, a sort of anatomical compensation for the very imperfect condition of development of the soft parts (lips, cheeks, and tongue) of the front opening of the elephant's mouth.

We must next consider certain peculiarities and physiological views concerning the action of the stomach and œsophagus. The *Gullet* is rather small in calibre for so large an animal and throughout its extent presents voluntary muscular fibre, so arranged as to admit movements of food pellets either up or down the passage. The mucous membrane of the gullet does not, as in the horse, extend unaltered in appearance into the stomach to line its left extremity. There has been described and figured a band of muscle running from the posterior part of the windpipe to the gullet which it has been supposed would so raise the stomach as to assist vomition. Recent very careful researches have not shown this muscle, which must have been very exceptional in



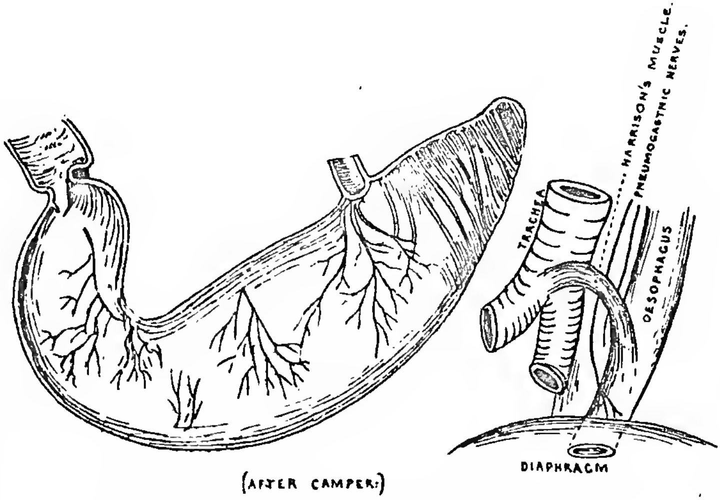
FASCIOLA JACKSONI.



AMPHISTOMA HAWKESII.

PATHOGENIC PARASITES OF ELEPHANTS

(AFTER COBBOLD).



(AFTER CAMPER.)

DIAGRAMS OF STOMACH AND OESOPHAGUS OF ELEPHANT.

(FROM EMMERSON TENNENT'S NATURAL HISTORY OF CEYLON.)

PLATE-6.

ALEX. BARREN, LITHOG. MADRAS 1886

the specimen from which it was figured. The stomach is elongated, small, and remarkably uniform in diameter throughout. It has no cuticular portion of its mucous membrane, but at its left extremity has a large *cul-de-sac* of a conical shape, the lining membrane of which presents slight transverse folds. Sir E. Tennent supposes this *cul-de-sac* acts as a water stomach, a view which has neither been proved nor disproved. However it is certain that the elephant can, by insertion of the trunk into the mouth, obtain, to throw over himself, more fluid than could be stored either in the pharyngeal pouch or in any other cavity in the throat and the arrangements of the œsophagus are such as to facilitate regurgitation. The only other use to which such arrangements could be put is for rumination, but we have no evidence that this occurs in the elephant. VOMITION however, does occur very freely under certain circumstances. Gilchrist informs us that sometimes, as a result of the animal being washed while heated, violent vomition sets in very suddenly, due to spasms of the stomach and active reversed peristalsis of the œsophagus. The stomach is so irritable that immediate rejection of aliment whether liquid or solid takes place, a condition which continues for several hours, hiccough and great distress are also present, the former of which symptoms seems to support the view that spasm of the diaphragm is present in these cases and causes obstruction at the posterior part of the gullet. At length it is found that food is retained but only as a result of paralysis of the gullet, into which the food passes, and in which it is accumulated, preventing the complete deglutition of freshly masticated pellets, for the animal continues to feed. Shortly a hard swelling becomes perceptible in the neck along the course of the œsophagus and the animal remains unable to swallow either food or medicine; at length mortification of the gullet sets in, as denoted by general coldness, after which death soon occurs. Whether the impaction of the œsophagus results from or is the cause of paralysis of the organ has not been clearly ascertained, the former view seems most probable. This disease is said to occur at any season and to prove very fatal. There are several points in connection with it which have not been thoroughly explained; thus we ought to know why the vomiting occurs, what is the actual seat of primary disorder, and on

what the paralysis depends. *Treatment* comprises withdrawal of aliment until the stomach regains its tone and then the gradual administration of easily digestible food combined with antispasmodics. It is the food accumulating in the œsophagus which induces mortification and the fatal result—if some of the food has already become impacted measures must be taken to free the passage, firstly by fomentations and external manipulations over the course of the œsophagus and then, if these do not prove successful, the surgeon will perform the operation of incision into the gullet rather than allow mortification to set in. There is no danger in making a bold cut down on to the distended gullet but the wound is apt to take a long time to heal. As after treatment the administration of stomachics and astringent tonics such as Chiretta and Gentian is indicated, but not the more powerful stimulants, such as chillies, pepper, &c.

The Intestines. I.V.S. Steel records the length of the Bowels of a male elephant, 9½ feet at the shoulder, destroyed at Poona, 23rd May 1882:—Small Intestines, 76 feet; Cæcum, 5 ft.; Colon, 20 ft.; Rectum, 12 ft.; Total Large Intestine, 37 ft.; Total length of Intestinal Tract, 113 feet. The Bowels in appearance resemble those of the Horse—the Cæcum presents three longitudinal muscular bands and is puckered to form numerous pouches. The valve between stomach and bowels is large and strong.

The Digestive Apparatus being somewhat similar to that of the Horse we might anticipate a corresponding agreement of disorders, as, to an extent, is the case. Thus we find on record cases of Spasmodic Colic with Intussusception in consequence; also, Flatulent Colic and Enteritis—but are by no means prepared for Gilchrist's account of vomition being frequent although no medicinal agent is known to cause emesis in the Elephant. The *General Symptoms of Abdominal Pain* are restlessness, crossing the hind legs or resting one hind foot on the other, lying and rising very often, lashing the sides with the tail, opening the mouth very wide frequently, inserting the trunk (which seems shrunken) into it, and champing the jaws. Simple Colic: is characterised by *sudden* access of abdominal pain which occurs in paroxysms, and is indicated by the abovementioned symptoms to be severe while it lasts. No fever is present—but the bowels are generally somewhat torpid. It results from some kind of

irritation of the bowels giving rise to spasm. Some acrid substance in the food, presence of worms, even exposure to cold when the body is heated is apt to bring it on—usually it readily yields to treatment but cases have been recorded in which the bowels became so entangled (Intussuscepted) as to give rise to death. V. S. Powell found this condition of 22½ inches of the small bowel from the stomach—the entangled part was filled with firm fibrine, and parasites were observed in considerable numbers in the Large Intestines. *Treatment*: Antispasmodic doses; enemata: and, if judged necessary, a cathartic dose, when the spasm does not seem to yield, the bowels remain torpid, and *inflammation has not set in.* Foment the abdomen freely or apply stimulating applications to it.

Flatulent Colic—(The animal is said to be "*Soost*" when affected with this disorder)—generally occurs under a subacute form in the elephant—being somewhat frequent. The bowels of this animal are very liable to deficient tone leading to imperfect digestion, distention of the abdomen with gas, colicky pains, and violent rumblings of the bowels. The appetite is impaired or depraved, the fæces abnormally soft and pale, the general condition reduced, the animal being listless and dull in the extreme. "After crossing large rivers, when elephants have been several hours in the water at a time, some of them are sure to have swallowed a large amount of water and will appear swollen out to bursting point in consequence. These will generally refuse their food" (Hood). *Treatment:* must be directed to improving the general tone of the system, and that of the bowels in particular, by the use of a liberal supply of nourishing food, iron and vegetable tonics—with mild stomachics as aids to digestion. Ginger, Gentian, Chiretta, and Assafœtida are useful in such cases. Regular exercise must not be neglected.

Enteritis: is said to be frequent in hot weather and to result from too free use as ordinary articles of diet of highly stimulating food, such as peepul leaves. The symptoms are those of dull subacute abdominal pain, fever, and a slimy coating of the small amount of fæces passed every now and then.* *Treatment* consists in fomenting the belly freely, abstraction of

* A case supposed to be enteritis is recorded in the *Jnl. Comp. Med. Surgery* for April 1884, in which an occasional thumping was to be seen on both sides of the hypochondriac region (recorded by G. Bowler, M.D., V.S.)

blood, and the administration of doses of Gum Opium with Calomel—even when this is carried out judiciously the case generally proves fatal.

Diarrhœa: assumes two forms in the elephant, the non-parasitic and the parasitic: It is denoted by a "loose state of the bowels," the fæcal evacuations being watery and foul smelling. There is generally some abdominal pain and, when the disarrangement has been present for a few days, its effects are marked by loss of condition, and dullness, with debility. This is generally an effort of nature to throw off some irritant from the bowels the living membrane of which becomes congested and even, later on, inflamed. The ordinary mucous secretion of the bowel is increased in quantity and a considerable amount of watery matter is thrown into the bowel with it. The animal becomes somewhat feverish and very thirsty in consequence of this drain on the liquid constituents of the blood. As in other forms of indigestion, the appetite is very capricious and the patient will eat mud and sand; the latter symptom being most frequent in the parasitic form with which we shall deal more in detail presently. Among the most frequent *causes* are food improperly prepared or of bad quality or irritating properties, also exposure to cold, and bathing the animal when heated. Coarse innutritious fodder is especially liable to induce the chronic form.

Treatment:—must be directed, not so much to stopping the diarrhœa, as to regulating its effects on the system. Indeed, as nature's means of removing irritants from the bowels, the purging is to be encouraged in the first place—by small doses of aloes and cordials; later the astringents, such as chalk, catechu, and galls may be required. Rice conjee should be given liberally, and the animal nursed and sheltered in every way possible. The after treatment will consist in very careful regulation of the diet.

Dysentery: When inflammation becomes confirmed as a sequela of diarrhœa the evacuations become coated with slimy lymph and intermingled with blood—and they are either soft or hard, or of a mixed consistency, small hard particles floating in watery slime and blood. Fever runs high, there is much straining, and the animal attempts to find relief by pressing the belly against the ground. Such cases generally prove rapidly fatal. *Treatment*: Food to be given only in small quantities

and of a highly nutritious character, as milk, suttoo, conjee. Calomel and Opium must be administered internally and demulcent enemata may be given with benefit. It must be remembered that dysenteric symptoms are found in an epizootic disorder of elephants resembling Rinderpest of cattle.

Cases of INTESTINAL OBSTRUCTION have been recorded. These depend generally on accumulations of woody fibre. It is a standing joke that a V. S. called to treat such a case had to utilize the *fire engine* as an enema pump. It is satisfactory that this case was successful, for the story goes on to say that the elephant passed a *tree* and immediately experienced relief!

PARASITES IN THE ALIMENTARY CANAL OF THE ELEPHANT.—The most interesting resemblance between the disorders of the stomach and bowels of the elephant and the horse is to be found in the fact of each (in India) being frequently invaded by parasites, especially those known as Bots and Amphistomes. The learned zoologist, Dr. Cobbold, has specially investigated the parasites of the elephant and embodied his results in a paper read before Linnean Society. From this we learn that the internal parasites which may be found are of twelve different kinds, being either Round worms, Flukes, or Bots; the flukes are of the greatest practical importance, as giving rise to two serious and often fatal disorders. Both in the Horse and Elephant *Round worms* are liable to burrow in the coats of the stomach and there form for themselves "abodes"—these occur as tumours occupied by burrowing channels in the mucous membrane lining the elephant's stomach—it has been found by Dr. Cobbold that the larger and smaller of these abodes are formed by different species of worms. No practical importance can yet be attributed to these parasites. One round worm occurs in both stomach and intestines—three other species have been found in the latter organs, they vary in length from 9 lines to 3 inches—and an even larger form is said to occasionally occur in the Bileducts. We have no evidence that these inconvenience the animal in any way.

Three species of *Flukes*—of the kind known as amphistomes, occur in the bowels—only one of these is of any importance. It has been named Amphistoma Hawkesii by Dr. Cobbold after Colonel Hawkes from whom he received specimens, and who has written on the disorder to which it gives rise (Veterinarian, 1875).

Lungun is parasitical diarrhœa. It is the most frequent disease of government elephants, and proves fatal in some cases, such as when it occurs among young animals, improperly fed and tended, as in the notorious outbreak among Sangar's Circus Elephants described by me in the Medical Examiner, 1878, p. 886. Death results from exhaustion, which is caused by the drain on the system effected by these animal parasites in two ways, firstly, by irritation causing profuse diarrhœa, secondly (in all probability) by direct removal of blood from the mucous membrane of the bowels to which they adhere with the greatest tenacity by means of their suckers. I wish it to be clearly understood that although the animal dies from exhaustion of which the parasites are the cause, it is only because they are present in very large numbers that they are enabled to produce such serious effects, and they do so the more readily when the elephant they invade is already weakened. Almost every Government elephant in India has some of these flukes in him, in some cases they become so numerous and cause such irritation that purging sets, and thus they are got rid of, in a few cases however the system of the elephant is not strong enough to resist their attack. Parasites of a closely allied species occasionally cause the death of horses in India; Dr. Cobbold, indeed, considers that the true elephant Amphistome has also been obtained from the horse. *Symptoms.* Those of ordinary diarrhœa of a severe and persistent character, preceded by a tendency to eat earth which renders the fæces muddy, and also the dung contains, generally in enormous numbers, small translucent bodies of a pink colour resembling soaked barley grains ($\frac{3}{8}$ of an inch by $\frac{1}{4}$). Careful examination will make it evident that these are Amphistomes, and will disclose a circular sucker at each extremity of their elongated bodies. When the diarrhœa has persisted for some time the symptoms of zerbad set in, œdematous effusions occurring about the head and shoulders and the animal sinking from debility. *Post mortem examination* if made immediately after death shows these parasites adherent by their suckers to the mucous membrane of the Large Intestine, some also being free in the cavity of the bowel. The Intestine exhibits signs of irritation especially in the form of gelatinous effusion between the coats—generally other parasites are to be found in the Stomach, Intestines, or Liver—these whether Bots, Round worms, or Liver

Flukes possibly assist in giving rise to irritation of the bowels. The other organs of the body are anæmic and more or less dropsical and the blood is very deficient in colour. There are several questions about these parasites and the disorder to which they give rise which have not yet been definitely settled.

(1.) Does the amphistome suck blood from the host—Dr. Cobbold objects to the conclusion that it does, saying this would necessitate the fluke relaxing its hold to expel any of the blood it could not digest. We have no evidence that it does *not* do so, the worms are often found free in the bowel and their reddish colour seems to be due to blood.

(2.) Gilchrist is evidently somewhat "mixed up" over the parasites expelled in Lungun. Dr. Cobbold's researches have left little doubt as to the true position and characters of these worms: That which is described by Gilchrist as the "mussodee of the mahawats" may be either the amphistome or Fasciola Jacksoni such as we shall directly describe. All the round worms are included by him under the names soorti, shotee, chotee.

(3.) Do the elephants select a special kind of earth in these cases? Forsyth thinks they prefer red earth, but practical observation shows that they will take what they can get rather than go without. It seems that wild elephants get rid of such parasites by resorting to salt licks, the Chloride of Sodium of which acts not only as an aid to digestion, but also as an antiparasitic and cathartic. Experience shows that Kala Nimak (black salt) is the best agent for use in these cases. Lungun is often associated with deficient salt ration or misappropriation of the salt allowance, which is very liable to occur since this necessary of life is heavily taxed and proves an expensive article in India Deductions from the pay of the mahout while his animal is suffering from this disease will tend to shorten its duration and lessen its frequency.

(4.) Is the earth the cause of purgation? It is said that by instinct the animal eats earth to free himself from the parasites by thus inducing purgation—also the mahouts give a bad name to elephants which do not periodically eat earth, and say that they "do" badly. Other Herbivora when suffering from abdominal irritation and indigestion exhibit depravity of appetite and eat earth; does the elephant simply do this or is he guided by special instinct? The fact that he eats earth is the more remarkable

because he naturally is very careful to free his food from dirt adhering to roots, &c. It is certain that shortly after he has eaten earth the purgation sets in and very possibly there is some guiding instinct, but that the earth is not the whole and sole cause of purgation was shown in the Sangar cases, they constantly searched with the trunk, gathering small amounts of dust and feeling for anything cold about the fittings of the stable, and they were not supplied with earth yet succumbed to diarrhœa although treated with enormous doses of astringents. There is some discrepancy in the statements made as to the amount of earth taken, Forsyth puts it at 10 or 12 lbs., Gilchrist at 1 or 2 seers.

Causes: We are told that "this disease was not present while the elephants were getting green food but showed itself afterwards when they were put on dry fodder entirely." This looks very much as if the parasites were conveyed to the elephant by the green fodder (since the disease manifested itself after that article of diet was used)—the larval form possibly inhabiting small mollusks or other soft bodied animals on the forage stalks. Gilchrist hints at the possibility of communication by contagion, he having observed a number of animals in the same place affected apparently in sequence. It is not probable that this depended on contagion, but rather that the animals simultaneously invaded succumbed in turn as the loss of resisting power together with the severity of invasion, proved sufficient to cause sensible interference with the animals health: *Treatment*, apart from that recommended for diarrhœa in general, we must stop the Ratib—experience has shown that if this be not done severe flatulence and indigestion will ensue, a condition known as "*Mookundha.*" Also it is clear that the animal should be allowed to freely indulge in the tendency to eat earth, and liberally supplied with salt. As a preventive means the last ration may be always increased when the animals are on green fodder. The debility which results from Lungun, constituting its advanced stage, must be treated as heretofore recommended. The ejecta and parasites passed by elephants suffering from Lungun as also those obtained post mortem should be destroyed by means of *fire*.

Fascioliasis or "*Rot*" of Elephants very closely resembles the disease of the same name as seen in the sheep being due to the

presence of a Fluke (Fasciola Jacksoni) in the Biliary ducts of the Liver causing disease of that organ to such a degree as to seriously debilitate the "bearer," or cause death. Dr. Cobbold says, "As causing disease, and zoologically speaking, this entozoon is the most important of the whole group of parasites infesting Elephants" but, we have already shown that it is of much less import than the amphistomes. In one of the outbreaks described by Dr. Cobbold as being "Rot" it seems that the evidence rather shows it to have been Lungun, for although V. S. Adams who made the post mortem examinations found many flukes in the Livers he could not detect any of the disease to which they give rise (such as must have been very familiar to him from the Livers of "Rotten" sheep) and Colonel Hawkes, who has shown himself a very competent authority on matters relating to the elephant, strongly suspected the amphistomes of doing the mischief. However the "Burmese outbreak" seems to have been one of true "Rot." The "Liver Fluke" of the elephant although closely allied to the familiar parasite of the same name as found in the sheep is rounder in outline and differs otherwise to an extent sufficient to mark it as a distinct species. The manner in which it causes disorder is by collecting in sufficient numbers in the liver to cause morbid changes in that important digestive organ and by consuming the bile which should be utilized in digestion. Jaundice and progressive debility set in but without the purging seen in Lungun, finally death occurs and postmortem examination shows the bile ducts blocked with the flukes which are collected into groups, the walls of the ducts thickened, and some few flukes free in the bowel cavity.

Treatment, (preventive and curative): stimulant, tonic, and, in general, as for Lungun. Dr. Cobbold says "there is every likelihood that the mollusk harbouring the Cercarian larva of Fasciola Jacksoni is small and possessed of amphibious habits. Not impossibly more than one mollusk is concerned in this intermediate office. Be that as it may, we shall never settle this question in connexion with the flukes of the elephant unless our Indian Zoologists take up the study of parasites in the same earnest spirit in which so many of them have advanced other branches of Natural History."

Bots:—In the stomach of both the Indian and African Elephant have been found larvæ of the Gadfly, known as "Bots", familiar to most of us as occurring also in the horse. {The Bot of the elephant is however specifically distinct from that of the Horse, the former is the larger being sometimes 1 inch in length. I found that they when removed from the membrane of the stomach struggled violently and several grasped my finger firmly with their hooklets. We cannot attribute any clinical importance to these parasitic grubs, which are technically known as *Gastrophilus elephantis*, and Dr. Cobbold thinks it "not improbable that the ova in question (those which we have already mentioned as found on the tusks) have been deposited by the mature fly of this gastrophilus."

APPENDIX, 1: ON THE BILIARY APPARATUS.

The *Liver* of the mature elephant weighs about 52 lbs., it is simple in its outline, less broken up than that of the horse, and we have observed that *the umbilical vein ends in the vena portæ.* There is no gall bladder, but the simple excretory tube dilates into a sacculated pouch where it opens into the Small Bowel, and into this pouch the pancreatic duct opens: parasites are sometimes found in this dilatation.

The parasitical larvæ of a tapeworm of the dog, known commonly as Hydatids, technically as Echinococci, have been observed in the liver and lungs of the elephant on post-mortem examination. They are white tumours either on the surface or in the substance of the organ, from which, when they are cut into, forcibly escapes an opalescent fluid in which examination under the microscope enables us to detect tapeworm heads. They do not, apparently, interfere with the health of the elephant but *liver or lungs containing them should always be burnt.*

Hepatitis or Inflammation of the Liver generally assumes a chronic form in the Elephant, but (as a case of *abscess* in the Liver of the Elephant recorded in the *Veterinarian*, 1877, p. 762, shows) is occasionally acute. When, with subacute fever, the bowels are very irregular, the dung dry and dark coloured, the urine high-coloured and scanty, the respirations laboured, and the patient restless and sleepless, and the abdomen distended, this disorder may be diagnosed. Gilchrist says "On the whole, the existence of

Inflamation of the Liver is more to be inferred from the absence of any affection of the bowels, or of the head, while the animal shows evident symptoms of the existence of some serious affection, than from the presence of any distinctive symptom or collection of symptoms. Frequently the lungs are consecutively affected and dissections show abscess more or less extensive in the right side of the liver and right lung. The appetite is variable; but thirst always great." This disease does not seem to be frequent—probably not because elephants in captivity are always given enough exercise but because they are almost always so considerably underfed. If called to such a case we would try Sal Ammoniac, which has proved so valuable for Liver disorders in man and the horse. Aloetic doses to act as a laxative, vegetable tonics, and mild liver stimulants may be resorted to, or the use of vegetable bitters may be tried. In acute cases some such treatment as that suggested for enteritis should be adopted.

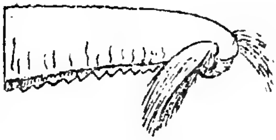
CHAPTER V: ON THE RESPIRATORY APPARATUS.

The Trunk or Proboscis almost deserves notice under an independent heading, so varied are its uses and so important is it to the animal. It is an organ of touch, of prehension, of suction, of respiration, also of offence and defence, and as such is essential to the animal and supplants many other organs such as in various animals are accustomed to perform its numerous duties. The Trunk is so special and remarkable an organ as to have attracted careful notice from the earliest times. Its anatomy and physiology are thoroughly known. The two passages through this organ are something superadded to the ordinary nasal passages the anterior limit of which is indicated by presence of the movable cartilages usual in mammals. From each nostril a tube lined by mucous membrane extends through the trunk to open by a funnel-like end at the free extremity of that organ. These canals lie nearer the anterior part of the trunk than the posterior and preserve about the same diameter throughout—they are united by fibromuscular substance, the red muscular fibres of which run from one to the other and possibly, by slightly approximating the mucous walls, they can assist in the dilatation of the tubes. It seems that the nasal cartilages which occur just posterior to an upward bend of the tubes are the obstruction by

which water taken into the trunk is prevented from flowing into the truo nostrils. Besides numerous vessels and nerves the bulk of the organ contains much voluntary muscle—which has been divided into a superficial set of muscles, which have fibres more or less longitudinal in direction, and a deep set, the fibres of which radiate from the canals towards the surface. The superficial muscles are four in number being a Levator, Depressor, and two Laterals. The Levator only is continued into the finger-like process of the free end of the trunk: as a rule the Trunk tapers from its large end above, where it emerges from the tissues of the face, downwards towards its free extremity where it expands into a sort of double trumpet shaped opening surmounted by a small extremely flexible finger-like process. This extremity is larger and more square in the male than the female, its openings are ovoid, and there is no notch below. The skin investing the trunk is delicate, especially that on its posterior surface, which presents transverse ridges giving it a permanent roughness. In prehension the finger-like process may be approximated to the posterior lip of the free end of the trunk, which thus may be used as a hand—or the trunk may be twisted round a large object such as a branch or a bunch of grass. Tennent mentions a case in which the forcible use of the trunk sufficed to break off a tusk of another elephant, and certainly the enormous amount of muscle in this peculiar organ gives it very great power and pliability. Cases are mentioned in which the trunk has been used otherwise as an offensive organ, either in striking or in wielding a stick or stones. But in warfare this part of the body is rather an impediment to the elephant than otherwise, for it is extremely vulnerable, and instinct teaches the animal to keep it as much as possible out of harm's way. The elephant when attacked by a tiger elevates the trunk to the utmost; a determined dog has been known to put an elephant to ignominious rout by a grip on the trunk; in days of old when horsemen charged elephants they were instructed to endeavour to injure the trunk; and when an elephant was burnt to death in Dublin the trunk was found "thrust near 2 feet into a very hard ground." In treatment of *Wounds of the Trunk* the principles of conservative surgery must be strictly adhered to, no part which can possibly be saved being removed, for after an animal

FIG: Y.

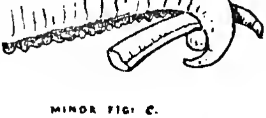
MINOR FIG: *a*.



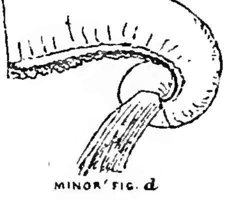
MINOR FIG. *b*.

FIG. X.

YOUNG ELEPHANT BROWSING



MINOR FIG: *c*.



MINOR FIG. *d*

DIAGRAMS ILLUSTRATNG USES OF THE TRUNK.

(FROM KNIGHT'S SERIES)

PLATE, 7.

ALEX. BARREN, LITHOG: MADRAS, 1886

has lost a part of this most important organ a large amount of extra care will be required to keep him in working order. We have already mentioned the liability of elephants to bleed to death from wounds severing a portion of the trunk. This accident, but to the less serious extent of partial division, is liable to occur from split bamboos drawn across their trunks in feeding; repair however takes place, and the mahouts object to removal of any portion however much it may have been isolated by the injury. The snake-like action of the trunk is beautifully exemplified when the animal is drinking water from a deep vessel; the end of the organ being introduced into water a quantity of the fluid is drawn into the trunk passages by an inspiratory effort. The water is probably prevented from passing into the actual nasal chambers by the valve-like action of the cartilages—but the tubes are dilated just outside these cartilages and so a considerable amount of water can be stored in these nasal sacs, the radiating muscles from which are so arranged as to make them very dilatable. The end of the trunk being passed into the mouth, the water is then expelled into the pharynx and swallowed with a peculiar gurgling sound. We have already seen that the reverse action may take place when the animal requires some fluid to squirt over the surface of his body. The idea, long prevalent, that the young animal sucks with his trunk is an error, as we shall show hereafter. As an organ of touch the trunk is very sensitive, especially its finger-like appendix—but it is probable that the mucous membrane lining the canals of the proboscis has little if any use as an organ of smell. We must remember that the trunk is to an extent concerned in the modulations and character of the animal's voice. From the large amount of muscular tissue in it the trunk affords us a valuable indication of the state of the body in general. A want of firmness to the feel and vigour of motion indicates a want of tone of the system in general; a contracted shrivelled trunk is a sign of fever and perverted nutrition of the body in general. A Paralysed trunk is seen in advanced debility preceding death, also in apoplexy and other forms of sunstroke. It is evident that loss of power in this organ from any cause acting through a length of time will render the animal, as requiring such an amount of care and attention as can seldom be given, practically useless to man; in the wild animal, such a

disorder must evidently cause death from starvation. But little can be done to remedy any injury to the nerves of the proboscis or to the bony channels through which they run, on which states paralysis is most likely to depend; therefore, unless he be a zoological specimen or a Burmese deity, an elephant affected with paralysis of the trunk of some standing should be destroyed. As might have been anticipated the nerves of the trunk are found to be very large, they are mainly derived from the fifth cranial root, the motor part of which is very large. Cuvier enquires into the question of how it is that the trunk can be *lengthened,* and comes to the conclusion that this is due to the intrinsic radiating and transverse muscles which, as they lessen the diameter of the organ, increase its length. It would seem that in addition to this there is a possibility of an "erection" of the organ, so largely is it supplied with blood vessels. This requires, however, further investigation; but a certain anatomist, in considering how the lengthening occurred, certainly forgot the penis when he said "we do not find any part without a bone, except this, that is protruded or prolonged, and so kept for some time."

The *Nasal Chambers* are small and vertical—the turbinated bones seem only represented by a flap of cartilage which constitutes a valvular arrangement (regulated it is said by muscle) over the rather large opening from the nasal cavities into the Facial Sinuses. The latter are appendages to the former, but attain a considerable importance anatomically, physiologically, and pathologically in the elephant. The nobly expansive forehead, seemingly indicating great cranial development is singularly deceptive on this score for (as in the owl) it depends on the large development of air-containing cavities in the bones of the face and anterior part of the cranium. Although the brain cavity is in the position which it ordinarily occupies in quadrupeds, the bones of the face are developed in so extraordinary a manner as to deceive us as to its exact locality. The Facial Sinuses may be divided into the maxillary and the frontal, they are present in all Herbivora and in many other animals, and their degree of development is somewhat proportioned to the total weight of the teeth; accordingly the elephant has them more developed than any other known herbivore. They compensate for the weight of the teeth by containing heated air which buoys up the head, at

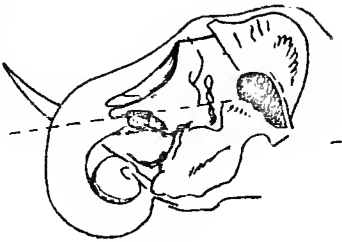


FIG. 2.

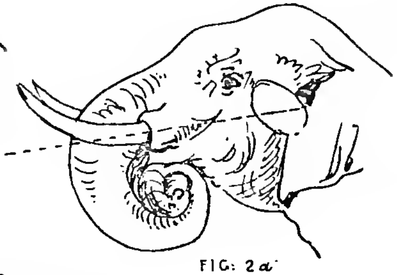
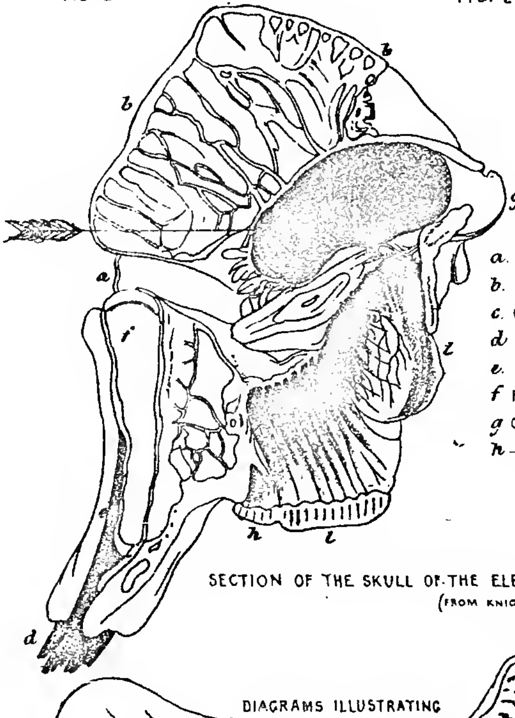


FIG: 2 *a*



a. NASAL OPENING.
b. FRONTAL SINUSES.
c. CRANIUM.
d TUSK.
e. FANG OF TUSK.
f PULP CAVITY OF TUSK.
g OCCIPITAL OPENING.
h -*n.* MOLARS.

SECTION OF THE SKULL OF THE ELEPHANT.
(FROM KNIGHT'S SERIES.)

DIAGRAMS ILLUSTRATING THE ANATOMY OF THE SKULL OF THE ELEPHANT IN ITS BEARINGS ON THE DESTRUCTION OF THE ANIMAL.

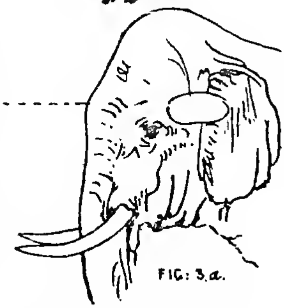


FIG: 3. *a*.

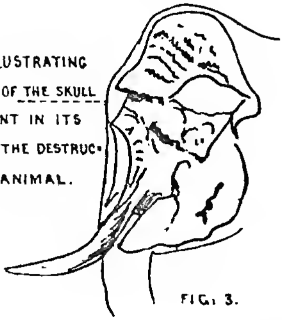


FIG. 3.

PLATE 8.

ALEX BARREN, LITHOG, MADRAS.

the same time they increase the extent of bone surface for muscular attachment without increase of weight. Also they protect the brain in animals which either fight or work with their foreheads or in the emergencies of a forest life are liable to fracture of the skull, since they remove the seat of collision to some distance from the brain. They are broken up into numerous subdivisions by irregular septa, the greater number of which radiate directly from the outer firm layer of bone to that directly forming the cranium and are thus valuable for resistance and, withal, thin enough to be elastic. Small and scarcely present in the young animal, the sinuses increase in size with age expanding the forehead and giving the roots of the tusks perpendicularity in place of their original downward and forward inclination and forming a large projecting boss above the root of the trunk. To sportsmen and those called upon to kill injured elephants it is most important to know where to hit them so as to cause immediate death by the bullet entering the brain. Inspg. Vety. Surgn. Steel, with a recent specimen before him, wrote:—"There are no powerful bones except one knob in front (the small aborted nasals), a walking stick may almost be driven through the skull from the sides. The Brain, only vital portion, lies far back and low. In a large male, say 9½ ft. at shoulder, brain's extreme length horizontally is one foot; vertically, ½ foot, shape oval. Three chief shots at the brain are:—

1. *Front* or *forehead shot*: On level ground, with head in natural position, a shot in centre of forehead towards top of hump at base of trunk and about 3 inches higher than a line drawn between the eyes is fatal.

2. *Side* or *temple shot*: if at right angles to the direction of the animal, aim directly into the ear hole in a line to pass through the opposite ear hole, or behind the eye in a line between its outer corner and the top of the ear—A bullet entering here will prove immediately fatal.

3. *Rear* or *behind-ear shot*: in the hollow just over the hump or swelling at junction of jaw and neck—must be taken at an angle of about 45 degrees from behind. Alteration in position of the head involves alteration in the line of fire; thus an elephant charging with his head high will have to be aimed at from in front a foot or so lower down than when at rest". These state-

ments concisely deal with the question, which has been extensively discussed by sportsmen and naturalists, of how the brain may best be reached. Gordon Cumming speaks of shooting elephants behind the shoulder close to the elbow, with a view of penetrating the heart, and there are some circumstances under which, firing from above, the junction of the head with the spine might be penetrated—the latter being a pretty sure way when it is necessary to destroy a patient for incurable disorder or injury. Occasionally wild elephants which have been much shot at are found with their foreheads riddled with bullets the perforations caused by which have partly filled up. In health the membrane lining the sinuses is very thin and transparent but it is the frequent seat of painful and severe disorder, INFLAMMATION OF THE LINING MEMBRANE OF THE FACIAL SINUSES, which may result either from prolonged exposure to a powerful sun with the head unprotected or from extension of inflammation in consequence of the intimate vascular connection through the bones between the skin on the forehead and this lining membrane. Gilchrist attributes it especially to the exhibition of stimulating mussauls to elephants worked in the sun, also to sudden cooling of the heated body surface by means of water—undoubtedly also bullet wounds admitting *cold* air into these cavities, which naturally contain warm air, may prove a cause. *Symptoms* of this disorder are obscure, but when an elephant with a sore forehead becomes feverish, dull, and even somewhat furious, we may surmise that extension of inflammation has occurred, and accordingly apply cold water over the head, bleed freely, and, if possible, administer a cathartic dose. The patient must be secured and kept in a cool shady place and very quiet. Such a diseased condition, once cured would be very liable to recur; probably many cases of so-called "*Sunstroke*" are of this nature.

CATARRH is of frequent occurrence and presents no special features in the elephant. The conjunctiva is generally involved, and watery fluid flows freely from it and the eye-lids are swollen. There is generally some fever present. *Treatment*, mainly consists in careful nursing and avoidance of exposure, and the exhibition internally of stimulants and febrifuges.

SORE THROAT [*Mumps* (Gilchrist)] seems to be rather frequent, but varies much in severity. Thus there may be only swelling

of the neighbouring lymphatic glands or severe and extensive enlargement of all the important structures of the throat, threatening the animal with suffocation and preventing the ingestion of food which is specially required in such cases to sustain the strength of the animal. Such extreme cases are not frequent, but when they do occur require promptitude in treatment. Tracheotomy may even be necessary, and there is no mechanical impediment to this operation, although we are not aware of its ever having been performed on the elephant. The Trachea is small in proportion to the size of the animal; the Larynx differs in one essential point from that of the horse. *Symptoms*: In addition to the local signs of Inflammation, there will be impediment to swallowing, general fever, and rapidly increasing debility. Gilchrist mentions that these cases are sometimes complicated by mortification of the Œsophagus from impaction, a mischance to which elephants are, as above mentioned, very liable. *Causes;* exposure, especially when the animal has been heated, is the principal. *Treatment,* must be, mainly, local fomentations and steaming through the mouth with nim leaf infusions; when possible, tonics and stimulants may be administered internally.

Lurza is a common disease due to bad feeding, loss of condition, or excessive exposure to wet or damp. Ulceration of the throat and mouth sets in, and the animal becomes unable to eat or swallow and dies in consequence; it usually commences by tremblings in the limbs and the rapid supervention of loss of power. *Another type of this disease* is where an animal, apparently healthy, is suddenly seized with "staggers" and falls. The natives consider this disease the same as cholera (Hood).

Of the Thorax and Lungs: In horseman's parlance the elephant is remarkably "well ribbed up," although rather flat sided and "short in the rib," also he is short and narrow in the loins and narrow chested. A horse with such points would be Weak and "Washy" not adapted for riding purposes, and quite unfit for cross-country work or draught; the only use he could be profitably put to would be carrying a pack.

The elephant has long and very narrow air passages and a diaphragm containing a large proportion of tendon and said to be covered anteriorly by an elastic layer. His ribs are nineteen in number on each side: those in front and those behind being very

short. But the most important peculiarity from a pathological point of view remains to be noticed, the *absence of a pleura*, which exempts the animal from pleurisy, hydrothorax, and the danger of wounds penetrating the Pleural Sac, thus materially reducing the list of of thoracic disorders. When dissecting the chest of an elephant I found that the lungs, instead of having their surface covered by a smooth layer adapted to glide over a corresponding lining membrane of the chest, were firmly adherent by means of elastic tissue throughout the whole of their surface to the walls of the chest; I was struck with this anatomical peculiarity but yet remembered an account of death of elephants from pleurisy, thus evidently either my observations were erroneous or the recorder of pleurisy in the elephant had described what from the nature of things *could* not take place. I found that Owen and other observers had previously noted this remarkable anatomical peculiarity of the elephant, but Miall and Greenwood, the latest observers, state "The visceral and parietal layers of the pleura are closely connected together by matted elastic tissue, while the pleural sac is at the same time pretty generally adherent to the Thoracic wall on the one hand and to the surface of the lungs on the other." I cannot help thinking that these anatomists lead us into error when they speak of the pleura and pleural sac as occurring in the elephant. The lungs are but slightly lobulated, their parenchyma is plentiful as in the lungs of the ox, their bronchi are only two in number (not three as in the ox) and the walls of the bronchial tubes in the lungs are described as devoid of cartilages, which gives the whole lung texture a peculiar softness under the knife. It is not hard to explain why there is no pleura in the elephant. His mode of life seldom subjects him to respiratory emergencies and his organization is such that he does not require much blood oxygenation. Only when the respiratory passages are wide and expansible, so that a rush of air in broad current can rapidly distend the lungs and cause extensive motion of the lungs on the walls of the chest is a pleura required—when the air enters slowly through narrow passages, as in the elephant and birds, a gradual expansion of the thoracic walls takes place and only such motion between them and the surface of the lungs as can be met by the yielding qualities of ordinary elastic tissue. As the respira-

tory system is poorly developed in the elephant so its diseases are few and not well marked. Those of us who are familiar with respiratory diseases in the horse will remark the infrequency of mention of coughs and abnormal breathing sounds as affecting the elephant.

INFLAMMATION OF THE LUNGS is described by Gilchrist. He says "It is to be observed, however, that this symptom (frequent wide opening of the mouth) is not always present but is confined to the most severe varities of the affection, and an inflammation of the lungs may exist, which, though less intense in degree and unmarked by any prominent symptoms, may continue a variable period, and eventually cause death, if allowed to run its course undisturbed. It is only by frequent enquiry into the state of the animal's health that obscure diseases are to be detected, as any change from the known healthy standard, will thereby arouse attention of intelligent subordinates to the animal's state." Here we have a good field for employment of those valuable aids to exact diagnosis which are the just pride of modern medicine, with the thermometer and the stethoscope to guide us we ought to have no difficulty in determining Inflammation of the Lungs. Such aids must not make us dispense with the simple means of diagnosis adopted in the days of Gilchrist. There is ample room for research with the thermometer and by means of auscultation in elephant pathology; the field is entirely untrodden. *Symptoms*: Restlessness, fever, cold surface of body, the animal does not lie down, but "coughs several times in an hour and opens its mouth wide frequently." *Pathology*: In acute cases suppuration takes place, but the nonveterinary observer must not in post-mortem examinations mistake cystic parasites (Echinococci) for abscesses; occasionally the disease assumes a chronic form. *Treatment*, comprises external stimulation, either by the application of irritant medicaments or by bathing with very hot water, and, internally, diffusible stimulants are required to support the strength of the patient.

BRONCHITIS. Congestive engorgement of the lining membrane of the respiratory passages occasionally takes place, the result of an unusual amount of work when the animal is out of condition. *Symptoms*: Cough, wheezing sound in respirations, breathing quick and frequent. *Treatment* consists in careful

nursing and avoidance of exposure, also administration, daily, of half a bottle of Rum, Arrack, or Brandy, and stimulant tonic mussauls. Gilchrist describes as *Apoplexy of the lungs* a disease which is evidently the pulmonary variety of Anthrax.

CHAPTER VI.—ON THE URINARY APPARATUS.

We have not to hand any observations on the physiology and pathology of the urine of the Elephant. His kidneys are, like those of the Ox and Bear, *lobulated,* and several tubes running from the kidney unite to form the ureter. Cases of BLOODY URINE are said to have occurred, but they have not been accurately observed; so we are not in a position to state whether the urine in them contained true blood, bile colouring matter, or broken down albuminoid material. The symptoms described are pain in staling, strangury (a voiding of the urine drop by drop). The disease is said to be very dangerous.

RENITIS: *Inflammation of the Kidneys,* is denoted by fever, abdominal pain, and swellings and pain detectible on pressure over the kidneys during rectal examination; the urine being either passed in drops or entirely suppressed. This disease is rare and liable to end fatally. *Treatment*; Free exhibition of mucilaginous drinks, such as saccharated water, linseed tea, and gram water, also avoidance of diuretics, administration of mild cathartics, and hot water applications to the belly, with frequent enemata. "The animal to be allowed ½ seer of the tender stock of the neem-tree during the taking of his mussauls" (Gilchrist).

Our knowledge of this part of elephant pathology, such as it is, is entirely due to Gilchrist, much remains to be done in the systematic examination of urine in health and disease.

CHAPTER VII.—ON THE NERVOUS SYSTEM.

The *Brain* of the Elephant is not large, nor is it remarkably small for the size of the animal. It differs mainly from that of the horse in the great development of the mastoid lobules; "The *olfactory lobes are large,* whilst the *Optic and muscular nerves of the orbit are singularly small* for so vast an animal; and one is immediately struck by the prodigious size of the fifth nerve, which supplies the proboscis with its exquisite sensibility, as well as by the great size of the motor portion of the seventh, which supplies the same organ with its power of movement and

action" (Tennent). We have elsewhere dealt with many of the mental and moral qualities of the elephant and we may conclude that he is a very nervous animal. Several serious diseases and derangements assume the form of PHRENSY. Musthee, Inflammation of the skin of the forehead and of the lining membrane of the Facial sinuses have been dealt with. In some phases of Anthrax fury sets in and renders the animal dangerous. But by far the most serious form of phrensy is ENCEPHALITIS, *Inflammation of the Brain and its membranes. Symptoms*—The attack is ushered in by excitement as manifested by restlessness, frequent lying and rising, and struggling to free himself, loss of customary obedience to the keeper, frequent shifting of the body, general tremors. Fever runs high and the trunk is contracted. There is frequent stretching and elevation of the trunk, conjunctiva congested, eyeballs protruding. The animal in this stage is furious and unapproachable but evidently unconscious of the mischief he is doing. After a time he loses power over the limbs, falls and is unable to rise, and shortly the case terminates fatally. *Causes*—High feeding; too free use of stimulants with a view to supporting the strength of the animal during arduous labour (Gilchrist), exposure to the sun, aud extension of inflammation from the membrane lining the sinuses, are the principal. *Treatment* is difficult on account of the fury of the animal. It consists in prompt and large abstraction of blood, constant application of ice and cold water to the head, free administration of purgatives and powerful febrifuges—opium is to be avoided as tending to increase the determination of blood to the brain.

APOPLEXY, in its preliminary stages resembles the above but there is confused action rather than fury. When, on the march under a hot sun, the animal commences to walk with uncertain staggering gait, and to tremble, to breathe hurriedly, and the trunk to lengthen and contract spasmodically, it is probable that some of the vessels of the brain have given way. The patient after a short time falls and becomes comatose, all power of sensation and motion being lost. The limbs perhaps quiver convulsively, and the animal rests on his side; enormous quantities of urine frequently are passed. Death may at once ensue or slow recovery take place. *Treatment* consists in the adoption of measures recommended for Encephalitis, than which this disease

is less fatal, it, however, is very liable to recur "at tolerably regularly returning intervals, usually about every fourth month; during the intervals, it (the patient) usually exhibits an excited demeanour; and, if opposed or disturbed by attendants will attempt to strike them with the trunk" (Gilchrist).

TETANUS or LOCK JAW.—The only case of this disorder which has come under my notice directly or indirectly was under the care of V. S. Mann, A. V. D. It resulted from exposure to cold and wet. The animal lived for some time, being supported by nutritive enemata, but at length succumbed. Gilchrist tells us that the mahouts treat by means of balls given *per anum* and the dose mentioned by him seems judicious. This remark however, does not extend to their treatment by pouring quicksilver into the external ear and plugging it in with opium, nor can we agree with Gilchrist that the opium so administered "most probably has considerable curative effect." Altogether the few accounts to hand of Tetanus in the Elephant seem to show that the disease is not frequent and generally neither acute nor very obstinate.

PARALYSIS OF THE HIND EXTREMITIES, PARAPLEGIA; we have no evidence that this has been observed in the Elephant as a disease *per se*, but occasionally it is seen as one of the forms of Anthrax. Of course injuries to the spine may give rise to it as well in the Elephant as in other animals. *Symptoms* "For several days previously to the setting in of the palsy the animal has an irritable, sometimes a wild demeanour, when it may attempt to strike the attendants; has no sleep at night, and leaves off taking fodder and water. Bowels regular, but urine is high coloured, scanty, and sometimes passed in drops. The surface of the body is cold from the commencement of the affection, and about eight days thereafter palsy of the hinder extremities gradually supervenes. During attempts to walk, the legs are as it were dragged; at length palsy supervenes and the animal is unable any longer to stand; feeling and power of limbs are completely lost" (Gilchrist). *Treatment*: Stimulating medicines, external stimulants to the loins, and tonics. Generally fatal results follow.

"BROKEN HEART" is the name given by Sir E. Tennent to sudden death which occurs when the animal is being captured or put into training. Tennent himself describes a case and Capt. Yule in his "Narrative of an Embassy to Ava in 1855" mentions

another in which an animal apparently fatigued by his struggles in training "lay down as if quite exhausted, then reared suddenly on the hind quarters, and fell on its side—*dead*!" This is a phenomenon remarkable in its nature and frequency. We have not enough information to enable us to decide whether the Heart has really given way or death has resulted from *shock*.

CHAPTER VIII.—ON THE ORGANS OF SPECIAL SENSE.

THE SKIN.—This organ in the elephant is very sensitive although very thick; harsh and coarse to the eye, it is just the reverse to the touch in well kept animals, indeed both Pathology and Physiology teach us how delicate it is. Its looseness of attachment to the tissues beneath by a large quantity of elastic areolar tissue adapts it well to admit of free and unrestrained movement of the different parts of the body, it also serves to render the apparent condition of elephants deceptive and to hide emaciation from any but the experienced eye. This looseness of attachment accounts for the great liability of elephant packs to work themselves loose and also for the ability of the animal by bringing the muscle of the skin, Panniculus Carnosus, into action to free himself from even apparently firmly secured trappings. It has been stated that the skin is not tannable. Surgically, the thickness of the skin prevents the pointing of abscesses, which are generally hard to the feel when fit for opening and their fluctuation is not preceptible. Some curious ideas were prevalent concerning the absence of surface hair on the elephant. As a matter of fact there are some varieties in which the "coat" is very well developed (in the Mammoth there was not only a long shaggy coat of hair but a shorter one of fur). The amount of wear of the hairs of the body is an indication of the age of a working elephant which affords a certain amount of information. The hairs on the tail are enormous stout bristles of horn, which are utilized by natives in the making of ornaments. Many elephants shed the hair of their tails, and the "Young Shikarry" expresses a fellow-feeling of sympathy for the sportsman whose first elephant yields him only a black, bald, wrinkled stump as a trophy! Tennent remarks on the lighter colour of wild than tame elephants, and it has been over and over again remarked how difficult it is to see wild elephants in the jungle because their bodies look very much like rocks. Of course

the darker colour of the tame elephants is due to the care taken of their skins, and often to their being prevented throwing dust and mud over themselves as a protective from the sun; also to the oil dressings applied and to grooming with a lump of clay or a piece of stone of a peculiar kind (Janwa). When ill-cared for the skin of the domesticated elephant becomes harsh, dry, unpliable, and loses its hair. This condition is familiar to us as occurring in diseased menagerie elephants at home and resembles the disease PITYRIASIS of other animals. It requires not only careful attention to the Hygiene of the skin in the way of frequent washings, applications of oil, &c., but the internal administration of tonics and carminatives similar to the Kharisk mussauls given to camels.

ECZEMATOUS ERUPTIONS occur on those parts which are exposed to the action of the sun, due to the want of proper precautionary measures in the way of clothing or anointing the surface prior to work during the heat of the day; sometimes, however, they depend upon disorder of the digestive apparatus. Simple Eczema must not be mistaken for disorder of the skin as seen in forms of epizootic disease. The eruption is generally first apparent on the poll and quarters, on which parts vesicles break out and burst to form small ulcers. The parts are tender and the discharge cakes on the surface. When neglected these ulcers are apt to run together and form nasty cracks in the flexures of the skin, difficult to heal and liable to be aggravated by friction. Lotion of acetate of lead proves useful in the earliest stages, afterwards dressings with carbolic ointment will be required. Laxatives must be given to remove any irritant or indigestible substance from the bowels. Then febrifuges and refrigerents, such as nitre and sal ammoniac.

The slightest prick of the skin generally causes a sharp shriek of pain, showing the extreme sensitiveness of the integument of the elephant, which on the march frequently bleeds from the bites of gnats and mosquitoes. *Flies* of various kinds prove a great nuisance to the elephant and often cause very serious detriment. Fleming in his "Animal Plagues" gives the following quotation:—
" A.D. 260: When Saphor King of Persia was besieging Nisibus, his elephants and beasts of burden were so suddenly and furiously attacked by swarms of gnats, as to kill or disable them, thus causing the siege to be raised, and subsequently leading to the

discomfiture of that monarch's army." *Theodorite:* Hist. Eccles. Book ii., p. 30. There is a curious legend among the Burmese in which the crow, fly, and frog are made to work the destruction of a rogue elephant. The former picking out his eyes, the fly depositing eggs (which developed into maggots) in the sockets, and the latter tempting (by its croak) the blind, thirsty animal to the edge of a precipice—over which the poor beast fell and was killed.

In South Africa, too, the *Tsetze Fly* has proved a serious enemy to the elephant, as to other large quadrupeds—its poison giving rise to anthracoid symptoms and rapidly fatal results. We have no record of the *Gad Fly* irritating the elephant, but it is certain that maggots of the *Common Fly* in the stumps of broken tusks and in other open wounds cause very serious inconvenience. They may be got rid of by camphorated or terebinthinate dressings or by Dikamali ointment or the juice of the custard apple. Flies are more troublesome in the jungle than in the open and are horribly frequent at certain times of the year. With regard to Ectozoa proper—a Mahout recently questioned by me seemed rather insulted when asked if he ever found any on his elephant and said they were seen only on diseased or very badly cared for animals. Dr. Cobbold tells us that *Hœmatomyzus elephantis,* a hugh louse, and a mite named *Symbiotes elephantis v. Homopus elephantis* (the position of which as a "good species" is doubtful, it, probably, being an acarus from straw) have been found on the elephant. A Bot, *Pharyngobolus Africanus* has been found in the pharynx of the African species.

Tennent argues that the white spots and patches found on various parts of the body of the elephant "are not natural; nor are they hereditary, for they are seldom exhibited by the younger individuals of a herd, but appear to be the result of some eruptive affection, the irritation of which has induced the animal in its uneasiness to rub itself against the rough bark of trees and thus to destroy the outer cuticle" and he argues that the scars of the deep wounds caused by the capturing ropes often remain white.

However, it has now been proved that the white blotches in question are only albinic spots (such as are found on piebald horses for instance) and their increase of size with age is only what might have been expected from our knowledge of similar

spots on other species of animals. The fact that the scars of large wounds are white does not disprove this view.

Boils of various kinds are most frequent in the elephant, appearing especially where the skin is thin, as on the face and inside the thighs, as circumscribed hard swellings which take a long time to "point" if left alone and will meanwhile do much mischief by the burrowing of pus beneath the skin. This is a form of mischief familiar to us in the horse in the case of deep seated abscesses in the region of the neck or back. It is more frequent in the elephant because of the amount and great strength of its fibrous tissue and also the looseness of the skin. Boils and abscesses of various kinds in this animal require to be treated boldly. An exploring needle, such as an ordinary trochar and canula, may be used to prove the presence of pus, then the skin boldly incised with a razor in a firmly fixed handle or an ordinary amputating knife plunged into the tumour to evacuate the pus by free incision. Oliphant found a Reade's Enema syringe very useful for washing out abscess cavities in such cases. Generally it is advisable, when the boils are numerous and extensive, to administer a cathartic dose and follow it up with diuretics. After abscesses have been opened they must be dressed with tincture of myrrh, or, preferably, turpentine ointment which will keep away flies. Before they are fit to open and for a short time after incision free fomentation is necessary. There can be no doubt that boils are generally due to derangement of the internal organs, especially the liver, and depravity of the blood. True boils are seldom accompanied by ill health. Occasionally however, they do not suppurate freely but persist as hard circumscribed swellings and finally disappear without bursting and the animal fallsaway rapidly. These are cases in which the boils are contemporary with rather than the cause of Zerbad, however, sometimes an eruption of blind boils constitutes a symptom of that disease.

Ulceration of the Skin of the Forehead—is not infrequent. This part, as a result of exposure to the sun, is predisposed to disorder, it is sometimes punctured viciously with the instrument known as the Ankuss or Hendoor Kookee, or bruised and abraded extensively when the forehead, unprotected by a pad, is pressed against a load or used in overthrowing a wall. It is said that

this disorder may result from Inflammation of the lining membrane of the sinuses, but the latter very much more frequently results from the former. *Treatment*—consists in putting the Mahout on short pay while his animal is incapacitated—free fomentations, and ordinary wound dressings; occasionally somewhat extensive suppuration takes place. After recovery (which generally takes some time) the greatest care must be exercised to protect the forehead from the sun, and to invariably use the forehead pad when the elephant is required for pushing, as this disease is liable to recur.

PROGRESSIVE MORTIFICATION OF THE TAIL is a somewhat frequent disorder and occurs even in elephants in good condition. Although it is attributed to the sun's heat we can hardly accept this as a full explanation of its causation. It seems to resemble the sloughing of the tail as seen in monkeys in temperate climates and a disorder of the same nature is seen in the camel and the ox—probably from an imperfect supply of nutritive fluid due to weak circulation or some such physiological condition. Ulceration of the skin of the tail occurs, after the hair has been shed, then the organ shrivels and dies from its free end, and finally but a stump remains. The animal is disfigured but not seriously damaged by this, which must be treated by stimulant applications to the organ and to the wounds resulting from sloughing.

THE EAR.—We have seen that the *External Ear* serves as a guide to determination of the species and age of any individual elephant. Its edges become frayed and scarred and white in colour with age. Also the organ is liable to considerable reductions in size and loss of substance by a *progressive ulceration and sloughing* similar to that which we have just described as affecting the tail, due to similar causes and requiring much the same treatment. Another disease of the skin of the external ear resembles that which is so frequent in long eared dogs and is termed "Canker." It is INFLAMMATION OF THE SKIN LINING THE EXTERNAL AUDITORY CANAL, from which escapes a fetid pus, it is very liable to recur. *Treatment* consists in nim leaves fomentations and syringing the canal with alkaline solutions or the solution of acetate of lead. It results from dirt, exposure to cold when heated, injury, or extension of inflammation from the outer ear into the canal.

Gilchrist describes A PARALYSIS OF THE EXTERNAL EAR, which however seems to be rather an indication of general atony than a disease *per se;* it indicates the necessity for a course of tonics. The *Internal Ear* has been described by Sir Everard Home (Philosophical Transactions, 1823) as having a muscular drum or Tympanic membrane, and so, although adapted to hearing sounds from a distance, quite nonmusical. But Home's conclusions are generally open to doubt, and even the anatomical statement has been denied, while there is ample evidence to show that the elephant can appreciate musical sounds and be guided by modulations of the voice. It is said that *Deafness* is not unfrequent in wild elephants, especially "Rogues," and that animals thus affected are proverbially dangerous, morose, and vicious.

THE EYE.—It is well known that almost the only chance of escaping an elephant in the open is to pass obliquely out of his range of vision; this range is limited in consequence mainly of the shortness of the neck. The eyes are small as also are the optic nerves. The appendages of the eye present some very remarkable peculiarities. There are fibres of the orbicularis palpebrarum running from both upper and lower lid to the Third Eyelid, and on to the surface of the latter pours the secretion of a gland, Harderian, which lies inside the orbit against the Internal Rectus muscle. This entirely replaces the true lachrymal apparatus, consequently *we cannot correctly speak of true tears of the elephant,* although Slymm feelingly describes the tears as rolling down the cheeks of animals cruelly maltreated with the ankuss. There is a depressor muscle to the lower eyelid and a muscular orbital periosteum. The diseases of the eye of the elephant present no special features.

CONJUNCTIVITIS is indicated by catarrhal flow from the eyes, congestive engorgement of the membrane lining the eyelids, and opacity of the Cornea. The natives say that it results from giving peepul leaves, and in too large quantities, as food. Forsyth tells us that the eyes very readily sympathise with the digestive apparatus, any disorder of the latter giving rise to *Opacity of the Cornea,* which is also attributable in some cases to the heat of the sun—hence very few elephants are seen with absolutely sound eyes. *Treatment;* fomentation with infusion of poppy leaves, exclusion of light, and dressings of acetate of lead are required. When

the cornea becomes thoroughly involved opacity may be associated with ulceration, which, however seldom leads to actual perforation. As the "tears" prove somewhat excoriating to the skin around the eye, the latter may be protected by inunction with ghee. In cases of ulceration it may be necessary to arouse the nutritive activity of the cornea by touching the ulcers with nitrate of silver. Gilchrist mentions outgrowth from the surface of the cornea as a result of this disease. This is known tecnically as *Staphyloma* and is called "mothea beenj" by the Mahouts, who recommend a number of collyria, many of them very prejudicial. Also in treatment of diseases of the eye of the elephant it seems that caustic agents are used to a deleterious extent, as when quicklime, sulphate of copper, and powdered lunar caustic are blown in between the lids. Many of the severe results of conjunctivitis as described are indubitably the results of malpractice; non-professionals when dealing with these cases may content themselves with the simple measures above described. To Veterinary Surgeons the treatment will prove similar to that to be adopted in the case of the ox or horse.

Opacity of the Cornea, known as *Leucoma* or *Albugo*, is confirmed whiteness of the transparent anterior part of the eye-ball. When recent and widespread over the surface some improvement may be expected with time and non-interference.

Blindness is rare, but may result from disease or injuries; occasionally the behaviour of the animal and the non-susceptibility of the eye to light is the only indication—it may then be attributed to some injury to or pressure on the optic nerve or to great loss of blood or disease of the brain. In other cases the transparent parts of the eye may be opaque. This infirmity seriously interferes with the usefulness of the animal and is generally incurable. The best way to stop a run-away elephant is to blindfold him.

THE FOOT—We have seen that the lower portion of the limbs of the elephant are invested by a peculiar horny modification of the cuticle, which we have termed the "Hoof slipper." This consists of sole and toe-nails. The former is a layer of soft horn covering the ground surface, rounder in the fore feet than in the hind, thinning and curling upwards at its posterior margin—but bearing anteriorly and on either side towards the front a variable number of toe nails with which it is fused in the same way as the

sole of the horse's hoof is with the wall. The upper surface of the horny sole has all over it pin-hole depressions for accommodation of villi of the sensitive sole—its under surface presents a number of more or less regular cracks. Although five toe-nails to each foot are looked for in the White elephant, five to each fore foot and four to each hind foot is the general number in the Indian species, the African having one less to each limb. They are not hoofs in the correct sense of the term, and bear but little weight. Occasionally they are extremely numerous, twelve or thirteen having been seen on one foot. A high-bred elephant of Ceylon may have twenty toe-nails on the hind feet (Tennent). The peculiar structure of the foot of the elephant enables him to progress with very little noise and so assists to hide his presence in the jungle. The natives consider their number and regularity a matter of import as bringing fortune or disgrace to the owner. The bones of the foot are so arranged that the true Knee and Hock of the elephant are a little distance from the ground—and the digits run obliquely downwards, the end bones each lying within one of the toe-nails and being but a poor and aborted representative of the hoof bone we find so well developed in the ox, for instance. On the anterior surface of this small bone are attached the sensitive laminæ which fit in between the horny laminæ of the toe-nail; they much resemble those of the finger nail of man. There is nothing very special in the arrangement of the tendons and ligaments of the foot—but between those behind the digits and the sole is a large quantity of fibrofatty substance constituting an important Elastic Cushion. The footing of the wild elephant is generally in soft soil, or over accumulations of fallen leaves, and so the hoof slipper suffices to protect the sole. Nevertheless, in wild as well as tame elephants this sole is sometimes penetrated by thorns, and Ouchterlony in his description of the structure of the foot, shows how these gradually become reduced in size as they are deeper penetrating, and he attributes this to a special fluid. Whether he is correct or in error in this surmise it is certain that often injuries of this kind cause but little or no lameness; sometimes, however, the thorns require to be cut down upon and removed and the foot put in a poultice. Circumstances are very different with the transport animal worked along hard roads and over rocky ground!

In a good working beast the lower margins of the toe-nails will be found worn, but on the march often this and the general wear of the pad lead to *Foot-soreness.* We have elsewhere dealt with the measures necessary to prevent this or to enable animals affected with overworn feet to continue at work. A predisposing cause is overweighting and we may recall to mind that too prolonged work on roads, also marching along the road directly after traversing marshes and rivers and before the feet have had time to dry act as causes.

SORE FEET or "*Thullee.*" Imperfect removal of urine and fæces from the picketing ground tends to keep the feet soft, and animals used in heavy draught are liable to overwear at the junction of the hoof slipper with the skin, a part not adapted to stand wear but exposed to friction by the unnatural work to which the animal is put. In acute cases the animal must be rested and the feet bathed with Alum water and the process of Chóbing, which we elsewhere describe in detail, resorted to.

"*Kandi*" or ABSCESS IN THE FOOT is a common form of disorder, the result of thorns or stumps of wood penetrating the horny sole, or the animal stumbling and bringing the foot down suddenly on to a sharp edged flint; also it has been attributed to cold, as from continuously marching over damp ground. The sole, too, may be bruised by the foot slipping on a rolling stone. Sometimes the mahouts wilfully lame their elephants to save themselves trouble and to avoid the risk of advance into an enemy's country. These cases being preventible with care, a mahout should always be put on stoppages while his animal remains lame. In acute cases the lameness is extreme, and inflammation runs high in the foot, which the animal constantly soothes with his trunk and cools by blowing water over it, and there is great flinching on pressure. When the case is neglected a true QUITTOR forms, known to the natives as *Bumbood* or *Tawakh* (Hood)—the escape of pus taking place either at the top of the nail or round the edge of the hoof slipper. In the former case the state of the parts much resembles that seen in quittor of the horse but in the latter generally the sole is extensively underrun. Either form may result from neglected Foot and Mouth disease. *Treatment*, consists in that ordinarily adopted for penetrating ulcers—including removal of horn sufficiently to make a depending orifice.

Occasionally antifly dressings are necessary. This disease is very obstinate and during treatment a leathern sole must be kept tacked by nails to the horn to prevent dirt entering the ulcer.

Cracked Heel, "*Sajhan,*" occurs at the junction of the horn with the ordinary skin. It is principally serious as depending on the constitutional state and being liable to recur every rainy season (Forsyth). The grand essential in its treatment and prevention is to keep the feet dry. The natives advocate washing the feet with Hookah panee in this disease, and morning and evening apply nitric acid with strips of copper, rubbing it well over the soles of the feet (Hood).

Inflammation of the Feet has been observed as a result of too free use of mussauls, high feeding, and prolonged work. It has been described as Laminitis from its resemblance to the disease of that name as affecting the horse—but the main seat of inflammation is, here, the sensitive sole. This disease generally results in a shedding of the Hoof-slipper in consequence of serous effusion between the horny structures and the sensitive parts which produce them; it sometimes occurs as a complication of Foot and Mouth disease. This disorder is very painful, the animal cannot stand, oozing takes place at the margin of the slipper, and fever runs high. *Treatment* consists in fomentations and other antiphlogistic measures, and, after the horn has been shed, careful protection of the foot until new horn has been produced in the form of a fresh slipper. In these cases death has been known to result from mortification setting in. We have a suspicion that the disease called *Chowrung* (*vide* p. 65), should be inserted here.

Cracked Sole is a sort of "chapping" of the sole, in which ulcers form along the natural groves of the part and prove obstinate in healing and liable to fungous granulations. It results generally from a foul state of the elephant-standing, and "is a common complaint in the dry and hot weather, and principally with animals which have been used for working in water during the previous wet season" (Slym). *Treatment* must be directed towards protecting the diseased parts and keeping them at rest by means of bulky adhesives—such as "Chòb"—or by tacking on a leathern sole or putting on an elephant boot.

Rope galls, often so severe as to leave permanent white scars, sometimes result from the ropes with which the animal is restrained just after capture. They frequently take many months to heal,

Horn Tumours and overgrowths with distortion of the toe nails sometimes require surgical attention, V. S. Nunn relates a case (in Veterinary Journal, November, 1882) where the outer toe nail of the left fore foot had grown to a sharp point in an inward direction curving to the right and causing a deep wound on the left side of the second toe, causing lameness of the animal. This he removed with an ordinary carpenter's saw, it cut like India Rubber. The parts were subsequently dressed with cherpine oil and rapid recovery took place. Slymm describes, somewhat indefinitely, *Horny fungus near the nails,* "not hurtful to the animal but liable to run into sores during the wet weather, it should be removed by cutting or applying the following:—Take a couple of dozen of marking nuts, boil them with oil for a half hour, strain the decoction through a cloth, and apply the oil to the fungus. Care should be taken in preparing (and using) the oil that none should touch the hands or come in contact with the face."

It will be noted that although the diseases of the feet of the Elephant are numerous and severe, and such as are liable to absolutely incapacitate him for service, they are mostly due to want of care in his management and so are preventible.

CHAPTER IX.—WOUNDS AND OTHER SURGICAL CONDITIONS.

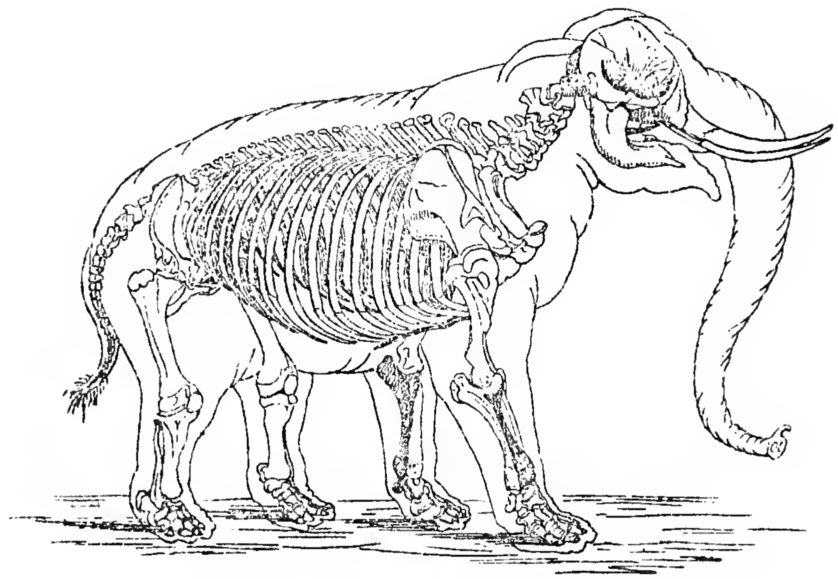
We need not enter into detail concerning the nature and treatment of wounds and tumours in general as seen in the elephant, since they differ only in very minor respects from those of other domesticated animals. We have already treated of gunshot wounds in relation to the skull as causing death, also of the very great import to be attached to injuries of the Trunk. There is a curious idea prevalent that wild elephants will plug gunshot wounds with lumps of clay. Sir E. Tennent in his valuable and most interesting work on the *Natural History of Ceylon,* feelingly alludes to the amount of suffering which must result to elephants from the number of non-fatal gunshot wounds which they receive, and quotes Gordon Cumming's account of Elephant Shooting in South Africa, which he justly considers loathsome in the extreme. There are two surgical conditions, however, to which special allusion must be made, on account of their importance on active service.

Capped elbow has been noticed by V. S. Nunn (Veterinary Journal, November 1882), as a constant source of trouble. The

Mahout neglects to spread the guddee on the ground to protect the elbows when the animal assumes the recumbent position to receive the load. Consequently tumours, resembling those so familiar to us as occurring in the horse, form on the points of the elbows. They are liable, if neglected, to form obstinate ulcers which render the animal almost useless for a time as being unable to lie down and receive his load. Prevention is much better than cure but such cases must be taken early and will, with proper care, then cause only temporary inconvenience.

HARNESS GALLS are either surface abrasions or abscesses. The former may result from excessive friction when the harness does not fit well or its leather parts have not been properly softened with grease or oil. They are of minor importance, and are most liable to occur at the breast piece, under the tail, or from the trace links. They do not generally throw the animal out of work, careful adjustment and care of the harness with a view to removal of the cause, together with applications of astringent lotions, suffice to effect a cure.

SADDLE OR PAD GALLS are much more serious, because they generally assume the form of abscesses and temporarily incapacitate the animal for work. Their principal and most frequent causes are:—I. The *saddle* fitting badly or not being firmly fastened on; its stuffing being rotten, unevenly distributed, or displaced by wear; its fastenings not being tight, so that they admit of movement of the saddle on the back. II. The *load* being unevenly distributed or liable to shift in consequence of imperfect fastening. III. *Malicious practices* on the part of the Mahout, whether application of caustics to the back or the insertion of a stone or some other irritant between the saddle and the back. *Pathology*: Either an open wound, or a serous abscess, or an accumulation of deepseated pus has to be dealt with; the most frequent seat being a little behind the tips of the shoulder blades. *Treatment*—Differs in no way from that required for ordinary wounds and abscesses (which see). V. S. Nunn, in recording his Afghan experiences, alludes to the case of an Elephant with a sore back, the ulcer being two feet in circumference, to which he applied as a poultice a flour sack filled with bran! It must not be forgotten that the Mahout is to be (under Para. 1726, Comt. Code) fined for negligence in most of these



MADRAS 1889   ALEX BARREN, LITHOG

PLATE, 9. THE SKELETON OF THE AFRICAN ELEPHANT. (LOXODON AFRICANUS) (AFTER HUXLEY.)

cases and the Pad repaired as much as circumstances will admit of, but not used again until thorough recovery has taken place. Of course on service this is not generally permissible, nor can the case be effectually treated by removal of the cause (Pad) in the earliest stages, much may, however, be done, by adjusting the stuffing and the load, to enable an animal with a sore back to do a fair share of work. The greatest care of the pads is necessary on service to avoid exposure to wet and to keep the stuffing in good order. According to a Bengal regulation in the Commissariat Code (Para. 1785) Elephants with galls are not to be used on the march, three camels, or a three or four bullock cart, to be substituted for each elephant to carry its load. Hood reminds us that, when treating wounds of the elephant, we ought to give the animal a sweatmeat after each dressing and take care to have the wounds constantly covered to prevent the access of dust and dirt such as these animals constantly throw over their bodies especially any parts which are the seat of irritation. The term *Kheel* is usually applied to small boils which occur especially on the back and flanks.

CHAPTER X.—ON THE LOCOMOTOR SYSTEM.

We may here simply recall to the mind of the reader certain peculiarities of the skeleton heretofore alluded to. The large skull with enormous weighty molars and correspondingly huge facial sinuses; the resulting shortness of the cervical vertebræ, and great development of Ligamentum Nuchæ and of the dorsal spines to which it is attached; the unusually large numbers of ribs and dorsal vertebræ, and the caudal region varying much in length and in the number of bones which it contains, even tending to shorten morbidly by dry Gangrene. The bones of the fore limb are remarkably like those of the hind, in each case the length is constituted mainly of three bones. Humerus and the two bones of the forearm (which cross one another like X) in the fore, femur, and tibia with fibula behind; and the complex knee and hock joints are low down against the ground just above the hoof. There is a rudimentary clavicle. The bones of support are arranged almost perpendicularly on one another. The effects of this are that the animal can stand upright without muscular exertion and that he is not suited for rapid locomotion (as compared with his size in relation to that of other animals). Also he may

be very completely and easily upset, for this arrangement ill adapts him for the recovery of equilibrium, when once it has been disturbed. The upright position of the support bones accounts for the discomfort experienced in elephant riding, and it indicates to us that the elephant is a beast of burden calculated to sustain weight but not adapted to throwing his weight into a collar. The bones are very strong, their articular surfaces not supported on narrowed necks, and their processes small. Hence Fractures are very rare in this animal. Gilchrist records a case where an elephant fell into a quagmire from which it could not extricate itself, so that in its struggles it broke its leg and had to be shot. He attributes such accidents to overloading, want of elasticity in the skeleton of the animal, and slippery soil causing severe falls. There is an enormous amount of fibrous tissue, especially of the yellow elastic kind, in the system of the elephant, and his ligaments are very strong. The *flesh* of the elephant is frequently considered good food, indeed the Burmese prefer it to any other meat; the heart, tongue, and trunk being delicate eating and the foot very useful for making soup. The majority of the muscles are tough and fibrous. It is curious to observe how some part of the healthy animal is always in motion, either ears flapping, legs swinging, tail lashing, or trunk prying about over everything near. This continuous motion, which in the horse would prevent "condition," is in the elephant one of the most valuable indications of the absence of disease. The red "flesh" of many of his muscles is very small in amount. This accounts for several facts:—firstly, for the remarkable endurance of the elephant: secondly, for his power of sleeping in a standing posture and even retaining that position after death; thirdly, for the infrequency of sprains; fourthly, for the difficulty in getting abscesses to point; fifthly, for the liability of the elephant to rheumatism; and lastly, for the infrequency of dislocations of his joints.

Sprains (*Lutchuk*), although infrequent, are severe when they occur, and apt to permanently incapacitate the animal. They are generally the result of over haste, carelessness, and overloading. They present nothing special as regards causes, symptoms, and treatment.

Chowrung is a term applied to a disease of frequent occurrence but doubtful pathology. Para. 1791 of the Commissariat Code commences thus "In crossing rivers if elephants are in a heated state they are liable to contract a disease called "Chowrung," if they be permitted to get a chill. Extreme cold has the same effect occasionally. The sinews become contracted and the animal can barely move. A dram of liquor or a few warm mussauls may prevent the disease, but months of care will hardly cure it, and the animal will be predisposed to it for the future." Gilchrist considers it a partial affection of all four feet and merely an advanced state of the condition known as *Gunruss* by the Mahouts; whereas Hood terms it "Weak Joints." The patient is stiff all over apparently and turns the feet outwards; in slight cases he is able to walk well and his efficiency is not impaired. Gunruss affects only the fore feet, occasionally it supervenes suddenly in apparently healthy animals as a premonitary symptom of Zérbád. *Pathology*: It remains to be decided in the future whether this is Rheumatism or spasm of the muscles, or (as seems most probable) a form of inflammation of the feet. *Treatment* comprises careful nursing and avoidance of exposure to cold, with doses of stimulants and antispasmodics internally.

CHAPTER XI.—ON THE GENERATIVE SYSTEM.

Section I.—*In the Male.*—The testes are small, globular, situated against the ilium, and suspended, each in its special Tunica Vaginalis, freely in the abdomen below the posterior extremity of the kidney. The Epididymis lies on the outer side, and the veins are remarkable for their number, large size, and free communications. There are four prostate glands. The free end of the penis is described as resembling a carrot, with a **Y** shaped orifice. The great drawback to the use of males for work is their liability to a peculiar sexual disturbance termed Must or Musthee (in Ceylon, Mudda) which comes on at times and renders the animal unsafe and useless while it lasts. Although some of the symptoms of this condition occur in the female at the rutting season they are not very marked. In the wild male although the other symptoms occur (most frequently in the cold weather from November to February) they are seldom associated with fury (Sanderson). It is, therefore, aggravated by confinement and varies

much in its method of invasion in different individuals, in some the fits coming on frequently, in others but seldom. This seems to depend to an extent on the condition of the animals, those highly fed and slightly worked being most affected. Its periodicity may be explained by cumulation of generative energy which the domesticated animal is not enabled to expend and which finds an outlet in this special manner. It has been supposed that male elephants as well as females "come into heat," and although they seem always prepared to pay attentions to females there are certainly times when the sexual instinct in them runs higher than at others and which may correctly be called "rutting times." These vary in period of duration from a few days to several weeks and if the constitutional symptoms are well marked the animal is said to be *must*. Then he becomes feverish, restless, sleepless, and requires to be picketed apart from others. On the occurrence of the earliest premonitory signs he must be hobbled, otherwise he is apt to break away from his picket and "*run must*," that is to dash about in blind fury doing what mischief he can. Quite recently we have read of such an occurrence in the city of Hyderabad and His Overfed Royal Highness of Siam (a white elephant) recently died after exhibiting signs of this peculiar derangement. There is a concomitant swelling of a remarkable gland on the temple and a more or less profuse brownish oleaginous discharge from the must-hole or ched situated in the region of the temple. This sexual physiological process does not occur before the animal has attained the age of puberty (25—30 years). *Treatment*—The animal having been duly and in time secured, it is advisable if possible to let the attack run its course without interference, or at most to reduce the fever by salines. I am informed that in the Rangoon wood stacking yards it is the custom when an elephant shows signs of must to lower his diet and give him extra work and this is found to prevent his becoming furious. Ouchterlony speaks of bleeding and castor oil doses but cautions against the use of Sedatives "which may stop the flow altogether and cause lethargy, sinking, and collapse, and even death." Slymm says "the following dose twice a day will soon compose it, camphor and opium, of each two drachms; sulphur, one ounce, made into a ball with jaggery. If it happens that the animal has become uncontrollable before the above medicine can be administered and that it has broken its

fetters, the best mode to recapture the animal is to take a dozen plantains which have been prepared with one drachm of opium each—throw these to the animal from a safe distance, and usually it will partake of them readily, and after having consumed from four to eight plantains (in proportion to the size of the animal) it soon becomes giddy, when the keeper can safely walk up and secure it." In view of the serious loss of services and danger from male elephants being liable to must, government now purchases only females for its use, and of the males now in the Service when they are in this state the ratib is to be reduced one-half, and green fodder given in compensation (Comt. Code, Para. 1771). As males are so much more strong and imposing than females, and as the elephant is used by us mainly for purposes of show or where great bulk and enormous strength is required, the liability to 'must' considerably lessens the total value of the elephant. In view of this important matter various Veterinary Officers, but especially I. V. S. Hallen, Superintendent of Horse Breeding Operations, have tried to prevent Musthee by CASTRATION, or SPAYING as it ought rather to be termed, however the intra-abdominal position of the testes and the size of the animal render this a very formidable operation and very frequently quite impracticable. Anatomical examination has shown that it is possible to reach the testes through an incision in the abdominal wall but the operation must be performed on both sides. The hugh bulk of the animal necessitates his being drawn into a hole dug in the ground after being thrown and properly secured. Then it is found that an incision in the usual position is of little use, for, the animal being "well ribbed up," the operator's arm is numbed by the severe compression it suffers between the last rib and the hip bone. An incision lower down is not of much value because the testis is difficult to reach and the arm introduced through the wound is so numbed by the pressure of the powerful abdominal muscles as to prove unable to draw the testis down from its superior attachments even if a fair grasp be obtained (which is not generally the case). Thus it is evident that all attempts to perform this operation without chloroform and the instrument known as the Ecraseur must be useless. Whether it can be done with these aids remains to be seen—possibly division of the nerves of the penis might have the desired effect; castration of recently captured young males as a routine procedure at

the capturing establishment would offer more chances of success and less difficulty in operating than making the attempt on old males when suffering from must. It is evident that so long as females suffice for government purposes this routine castration would not be economical, even if practicable, for the operation is severe and liable to be attended with fatal results.

The *Temporal Gland* or *Kuppool* is like a salivary gland in appearance. It is flattened between the skin and the temporal muscle and communicates with the surface by a short duct from its lower part. It is found in the female as well as the male. Its secretion is oily and odorous. It is an accessory reproductive organ analogous to the Larmiers or Tearpits of the Deer.

Inflammation of this Gland has been described as occasionally resulting from its excessive activity during Musthee, the discharge containing pus, and the temple being swollen and painful. It must be treated by fomenting freely, and the disorder will subside with the sexual excitement which caused it. Occasionally, on careful examination, a piece of wood may be found in the Ched hole or Kuppool duct, probably a thorn broken off short in the passage.

SECTION II.—*In the Female.*—The female generative organs are in some respects very remarkable. The womb is almost wholly divided into two horns and there is in the unimpregnated female a well marked Hymen. The vulva is very long and so curved ordinarily that its loose external opening hangs down very like and in the position occupied in the male by the penis—it forms a regular prepuce to the clitoris which in the young specimen examined by me was very like a small penis and measured over a foot in length. The extraordinary position of the generative opening has led to a wide spread doubt as to whether the ACT OF COPULATION is performed by the elephant in the position ordinary to quadrupeds. On medals and other native works of art the animals are represented *sub coitû*, the female literally standing on her head. Male domesticated elephants "toy" with females endeavouring to mount them in the usual way and the parts of the female are so arranged as to alter their position in consequence of erection of the clitoris under sexual excitement under which circumstances the external opening assumes somewhat the position ordinary to quadrupeds. This was observed by the ancient anatomists, Aristotle mentions it in his *Historia Animalium*; probably the weight and

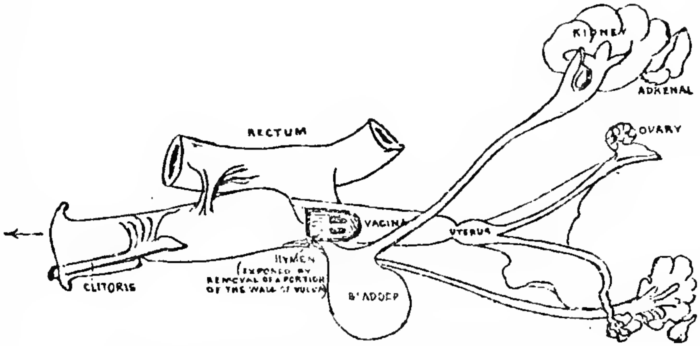
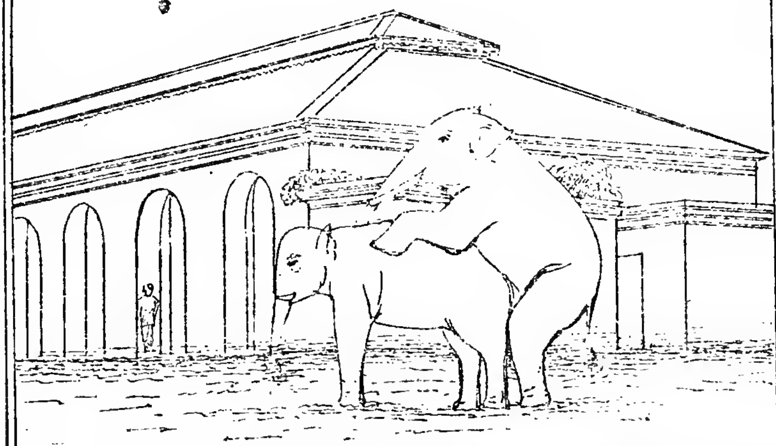
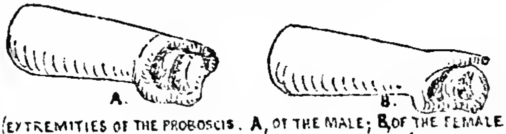


DIAGRAM OF FEMALE GENERATIVE ORGANS.
(AFTER MIALL.)



ELEPHANTS COPULATING (FROM A PHOTOGRAPH TAKEN AT THEYET MYO, BY MR JOHN PORTER, SCHOOL MASTER, 2ND BATTN BEDFORDSHIRE REGT).
THE FIGURES ARE NECESSARILY INDISTINCT ESPECIALLY THE TRUNKS & TAILS WHICH WERE CONSTANTLY IN MOTION
(ELEPHANT HOUSE IN BACKGROUND.)



(EXTREMITIES OF THE PROBOSCIS. A, OF THE MALE; B, OF THE FEMALE.)
(AFTER HOUEL.)

PLATE 10. – ILLUSTRATING SEXUAL ORGANS & DIFFERENCES BETWEEN MALE AND FEMALE ELEPHANTS, ALSO A FIGURE, FROM LIFE, OF THEM IN THE ACT OF SEXUAL UNION.

ALEX BARREN, LITHOG. MADRAS, 1895

vigour of the male sometimes induces the female to go down on her fore knees and rest her forehead against the ground, especially as the congress lasts for some time. A writer in the *Oriental Sporting Magazine* gives us some interesting details—"I have only once been a distant eyewitness to the copulation of elephants." * * * "A tusker seemed to be struggling in a pitfall with his head and fore quarters alone visible, the animal seemingly standing on his hind legs, endeavouring to escape from the snare. Upon my bringing my glass to bear upon him, I at once saw what it was. The female was standing in a deep but dry nullah which branched out from the main water course : it was not more than 5 ft. in breadth; the male had a forefoot resting on either bank thus in a great measure the weight of his body was thrown off the cow. The end of his trunk was twined round her throat; nearly ten minutes elapsed without their shifting their positions and not a sound was emitted from their throats while in conjunction. Ultimately, both animals moved off silently and rejoined the herd, which all the time had remained at a distance." Natives say one leap is certain to suffice, also that the animals take over an hour in copulation. This observation seems most reliable, and (with another case observed by a large number of officers in Thayetmyo, and photographed) ought to conclusively establish the fact : that the elephant copulates in the position ordinary to quadrupeds availing himself when possible of the conformation of the ground to lessen the burden of his weight on the female. We have already commented on the facts that elephants used to breed in captivity in the time of the Moguls and Carthaginians, that they do so in Siam in the present day, and that they have not the conditions necessary to enable them to do so in Anglo-Indian domestication—nor would it be economical to have elephant breeding studs so long as a sufficient supply can be obtained by capture. Females in calf or with calf at foot are sometimes captured, and the little ones make funny pets, being very playful, and sometimes very mischievous. The *duration of pregnancy* is said to be 20 mos. and 18 days (Corse); 22 mos. with male calf, 18 mos. with female (Sanderson). Instances of elephants breeding in captivity are given in the "*Asian*" for 5th June 1883. The duration of pregnancy was 583 to 680 days. The placental membrane forms a ring round the body of the fœtus, and the mammary glands are

two in number and situated under the chest. It was at one time thought that the young elephant sucks with his trunk, but it is now definitely ascertained that this idea is an error based on the fact that while sucking the calf caresses the mammæ with the trunk, and probably thereby assists the flow of milk. The nipple is grasped by the side of the mouth, and the dam bends the chest downwards that the little one may reach with ease, or is spared this labour by the care of the attendants in raising a small mound for the calf to rest on (Corse, Philosophical Transactions, 1799). It is said that the position of the two breasts in the female "enables the young one to suck as it runs along beside the mother or even under her belly" (Williamson). Ouchterlony says the young are sometimes fed by means of the trunk.

PARTURITION. Mr. George Artingstall has published a paper on Parturition in the elephant which is reproduced in the *Veterinary Journal,* July, 1882. "For the first few months the animal appeared as usual, but as she advanced towards full term she grew heavy and sluggish, until the last month, when she became decidedly lazy. One of the earliest symptoms noted was the enlargement of the mammæ which were quite prominent from the fourth month, but developed slowly within the last few weeks, when they rapidly gained in size, until they were about as large as those of an ordinary Durham cow. As near as could be determined each organ would measure from 6-8 inches from base to point of nipple, and at the base about 24 inches in circumference. Each nipple was covered until the day of delivery with a scaly coating. On the morning of 2nd Feb. 1882 the animal appeared about as usual, but during the forenoon the scaly crusts over the nipples peeled off and watery mucous discharge was noticed coming from the numerous openings of each. Close observation revealed the fact that each nipple instead of having a single or common opening had several—the right eleven and the left thirteen. About two hours before delivery there was a slight watery discharge from the vagina, and it was plain that the lips of the vulva were swollen, the vessels distended with blood, which appeared as many blue lines. When these symptoms were first noticed, the Queen was separated from the rest of the elephants, placed in a room by herself, and securely fastened. She kept on eating, and seemed perfectly well until twenty minutes before the baby was born. From that time until

birth she appeared a trifle uneasy, but gave no evidence of positive labour pains. The delivery was very sudden, and occurred while she was standing, having previously separated the posterior extremities to a slight degree."

"The baby presented head and front feet first, enclosed in its membranes, and appeared to be going up and out of the rectum, which appearance was accounted for by its passage over the pubic arch, and in less than three minutes it had dropped to the ground. The mother instantly straightened up, crossed her posterior extremities, and by rubbing them together soon severed the cord. The little one lay perfectly quiet, and apparently was not breathing; but the mother, as soon as the cord was broken, turned round, and with one of her anterior feet struck the membranous sac quite forcibly, which instantly broke with a loud report. After rupturing the membranes, she placed her foot on the thorax, and pressed it with the appearance of considerable force, raised it and pressed again, and repeated this operation several times, until the little one began to breathe and gave positive evidence of life, when she ceased and appeared satisfied. Now for the first time, she was considerably excited. This stage of excitement lasted for about half an hour. About this time the baby made several attempts to gain his feet, and finally succeeded, but was quite weak on his legs for a number of hours."*

"The mother gave every evidence of suffering more pain after the delivery, and until the placenta was discharged, than in giving birth to the baby. There was a low beam near by, which she got astride of, and settled down upon quite heavily until the afterbirth was discharged, which occurred two hours after the fœtus." This was accompanied by a slight flow of blood; after it the animal stepped back from over the beam, and appeared perfectly relieved. The calf commenced to suck five hours after birth.

* When we consider the sagacity shown by the elephant under various circumstances and the amplitude of detail of the above description, we shall have less difficulty, than we otherwise might find, in believing that the elephant cow will, *on emergency*, resort to artificial respiration with the newly born calf. We must remember, however, that no such remarkable behaviour has been recorded by others who have observed an elephant cow give birth and manipulation of the young animal, both in and out of its membranes, with the foot might easily be mistakenly supposed to have the objects above ascribed to it.

The milk has been shown, by Dr. Chas. Doremus, to be very rich with an agreeable taste and odour, and less water and more butter and sugar, than any other (*Med. Times and Gaz.*, 1881). Artingstall found that it closely resembled cocoa-nut milk and was secreted in quantities daily greater than that of the best Jersey cow and one-eighth greater bulk of cream. Corse found that after parturition the animal in about six months' time manifests *symptoms of heat* which last only a few days, there being slight swelling and congestion of the vulva, which also descends to a slight degree; when the female desires attentions of the male she utters certain sounds. It has been found that, although pampered and highly fed, white elephants do not breed, but this is probably due to their lax constitutions and general unhealthiness, for it is recorded that they are liable to enlargements of the joints and certain disorders of the skin.

[I have recently been informed that in the Karen country free breeding occurs among the herds of semi-domesticated elephants which constitute a considerable part of the wealth of people, and which are daily driven out into the jungle to graze.

So numerous are elephants to the west of British Burma, that, when any are required to carry loads of merchandize, they are impressed from the herd, and given a short day's march under a light load each, being replaced by freshly impressed animals for the next day's journey. Thus the natives get their work done without having to give their elephants grain food.

Elephant stealing is a branch of industry which has attained a considerable development along the Siam Frontier of Burma. It is carried on in the night and pursuit prevented by throwing along the track traversed pieces of bamboo joints so cut as to form three very sharp projections such as would severely lame pursuers, whether on foot or elephants. The elephant stealers show much skill in obliteration of distinctive marks. (J. H. S.)]

CHAPTER XII: THERAPEUTICS.

We have shown very clearly that much good may be done by the scientific treatment of elephant diseases. We wish now to show that it is economical to so treat them, and, as the intrinsic and pecuniary value of elephants is great, it would be worth the while of Government to encourage the study of the Pathology of the Elephant. Apart from the value to medical science and to the art of war of this study, it is not hard to prove, viewing the matter from a narrower standpoint, that there is at present great waste of medicines used in the compounding of elephant mussauls, due to the ignorance (not culpable however) of Europeans in charge, and to the ignorance and cupidity of natives. The facts which I wish to bring strongly into relief are—

1. That now usually when an elephant requires treatment either one of Gilchrist or of Hawkes' mussalahs is indented for. Those given by the former officer are very complex, Col. Hawkes' formulæ are much less objectionable. In other cases the mahout is supplied with what he considers necessary. Thus there is no skilled opinion as to the disease to be treated nor as to the remedy to be used. Upon this system much medicine must unnecessarily be expended.
2. The formulæ generally include a number of bazaar medicines—of which the mineral are *very* impure and their action cannot be relied upon—nor is their dose certain, for they constantly vary in composition.
3. They also include substances known to have no action of importance on the animal system.
4. They generally contain a number of substances so closely similar in action as to be interchangeable and the use of only one of these similar ingredients necessary.
5. They generally contain incompatibles—agents which by chemical, mechanical, or medicinal properties render each other inert.
6. They probably often contain curry stuffs and other such ingredients looked upon by the native attendants as perquisites.

Although, whenever possible, I have drawn on my own experience on the treatment of elephants, I have not neglected the informa-

tion given by previous authors—their formulæ, however, will some cases not be recognized when reformed by scientific revisi although their actions can be much altered for the better by su treatment. To the scientific therapeutist of the present day ma errors in Gilchrist's system of treatment will be evident at a m glance. Thus sulphur is considered "stimulant" in its acti cloves and coriander seeds are "cooling," black henbane is "co ing and carminative," and stramonium is "stimulant." We po this out not in a spirit of hostile criticism but rather to indic the very elementary knowledge possessed by Gilchrist and informants of the nature and action of medicines on the syst of the elephant and the way in which they may be utilized the treatment of disease. The ground was practically unbrol then; as far as we can determine from literature, it remains in same state now, *forty* years since Gilchrist turned the first so

The Mahouts knew only about the value of carminatives, some sedatives which they called "cooling" medicines. T never used purgatives. Their external applications have s value, but they were utterly ignorant of the surgical treatmen wounds, &c. Gilchrist and his school have introduced the "bl and physic" plan and also a little system into elephant medic have placed the native mussauls on paper and have thus gi some basis for future action. Col. Hawkes and Dr. Slymm, w adopting most of Gilchrist's ideas, have simplified his form and pharmacy, with considerable benefit in lessening cost promoting efficiency of the remedies. It remains to apply present therapeutical knowledge to this subject—and to w scientifically on the practical basis thus afforded.

I have decided, then, to—I. Give a list of ordinary Veteri medicines procurable in this country useful in elephant treatm with their doses and actions.—II. To notice agents which l been specially recommended in elephant treatment.—III. give some simple formulæ such as will prove useful in ro treatment and ought to be kept on hand and ready for use. latter are the more necessary because at present the disease elephants are seldom treated by Veterinary Surgeons and prescriptions will probably be more effectual and certainly do harm and cost less money than those which are otherwise li to be resorted to.

Concerning *the influence which peculiarities of constitution of the elephant exercise over the action of remedies.* "No medicine, whether animal, vegetable, or mineral is known to have an emetic effect on the elephant. Tartar emetic has been given in two ounce doses morning and evening, till half a pound was taken, but no emetic or other obvious medicinal effect followed." In this the elephant resembles the horse and differs remarkably from the dog, man, &c. It is curious that the Mahouts "never prescribe purgatives, such having no place in their Materia Medica. The aloes, indeed, is a common ingredient in their mussauls, but it is given with an alterative and tonic object" (Gilchrist). The list of *alteratives* for the elephant is large but it must be remembered that this class of agents simply includes those which do good *"we cannot tell how"* ! Certain important classes of agents, such as sudorifics, emetics, and antiperiodics, may, apparently be entirely omitted from this Materia Medica. Others such as stimulants, tonics, and vermifuges have a great importance.

As regards Doses; here, too, we have no certain guide. It seems that the great size of the patient too often suggests an excessively large dose. Our authorities differ extremely even over the simplest remedies and those most frequently in use. Much doubt must hang over this branch of the subject until careful experiments with simple pure remedies have been performed. We shall only indicate the probable dose likely to be effectual and free from risk, we have elsewhere stated that generally the *"doses given to the elephant must be double those for the ox,"* but have noted that (as Epsom salts for instance) there are many exceptions to this rule.

Pharmacy: To every elephant establishment should be attached a well appointed dispensing room to be used as a pharmacy and veterinary office. It is all very well to say that the Mahouts with their chatties, cowdung luting, impromptu mortars, and other means can sufficiently prepare elephant medicines. It surely cannot be denied that the European methods are the more exact, cleanly, and supervisable, and there is no specific virtue in native ways. It is most important to progress in elephant medicine that the exact European system replace the inexact and confused method hitherto adopted. We make these remarks lest it be suggested in opposition to our views that we have entirely neglected the elaborate macerations in chatties, carefully ordered mixture

of mussaul ingredients and so on, hitherto resorted to. We have done so on the same principle that the modern physician has laid aside the pompous manners and gold-headed cane adopted in the time of the Georges—because science now disdains to impose on the lay mind by trivial and unnecessary attention to non-essential details. Of necessity many bazaar medicines must be used in the treatment of elephants but preference must be given to those of them which are vegetable products and so less liable to impurity than mineral, and always good specimens free from insect ravages and dirt must be procured. The vehicles used in preparing the medicines for ADMINISTRATION are generally those palatable to the animal, gûr or jagghery, honey, spices, and so on; by their use the medicine may be given through the mouth either as a bolus or in the form of a chupattee; the latter will be eaten in the usual way, the former may be introduced as far back as possible into the animal's mouth either as it is or folded up in a piece of plantain leaf. "The administering of medicine is rather difficult with some animals, in such cases a piece of wood of the following description I have found very serviceable:—It should be 2½ ft. long, 6 in. broad, and 2 in. thick and should be put in the animal's mouth with the two ropes at the ends fastened to a rope previously tied round the neck, the centre hole should be large enough to allow the hand to go through with the medicine in the shape of a ball, and, if liquid, it should be put into a bamboo or into a plantain leaf. Many animals have to be well fettered before commencing this operation" (Slymm). The fact of the elephant having freedom of the posterior part of the tongue much increases the difficulty in administering boli through the gag, the tongue gives much resistance to the hand and pushes it between the grinders. It is wonderful how little room there is for passage of the hand to behind the tongue of even a big elephant, and often after the bolus seems to have been passed behind the tongue it is gradually returned and may be found sticking to the upper part of the opening through the gag. Thus some force is required in passing it over the base of the tongue, but once this difficulty has been surmounted the bolus must be swallowed. The best means of *administration of liquid remedies* seems to be by using the Read's patent enema apparatus as an artificial trunk; occasionally tasteless substances may be given mixed with the drinking water. Ouchterlony says that

sometimes in giving draughts it is found necessary to make the animal kneel down, secure him by fastening a chain under the forearms and over the neck, hobbling the fore and hind legs, inserting a crowbar between the grinders and injecting the draught; this certainly seems a formidable process and not likely to do a sick animal good! The natives suggest introduction of boli *per anum* in cases of tetanus, they being carried up as far as the arm can reach. *Enemata* are very useful in elephant practice, indeed the only article for elephant treatment mentioned in Messrs. Arnold's catalogue of veterinary instruments is an enema apparatus, which may be obtained at the formidable rate of three guineas! To *give an enema to an elephant* place him in some position where the forefeet rest much below the hind. If a Read's pump is not available use a syringe with a long nozzle. Let the tail be held up by two men sitting on the back of the animal. Introduce the nozzle, well lubriated, deeply and with an upward inclination. Inject the fluid slowly and steadily.

The method of administration of the future for the elephant will probably be *subcutaneous injection*. Although the sensitiveness of the skin is considerable this does not prove a very formidable obstacle to introduction of the trochar of the syringe, and the elephant stands surgical infliction of pain well and is said to exhibit a liking for the Surgeon who has afforded him relief.

Concerning the *use of remedial agents applied externally*; *Poulticing* is a formidable operation as requiring often a large bulk of substance—thus V. S. Nunn speaks of using a wheat bag filled with bran in a case of sore back. A very useful substance for poultices is the prickly cactus freed from its thorns and well bruised—or the common yellow thistle-like plant of waste places (Satianassee) similarly treated.

The method of application of *fomentation* is given with useful minuteness of detail by Gilchrist:—"Cow-dung is mixed with water. This, being heated in a large chatty, is applied to the body over as much of the surface as is deemed necessary for the particular malady under treatment. The application is continued uninterruptedly until a coating of it has accumulated, the thickness of which prevents the rapid dissipation of heat. When it is wished to foment the back and sides of an elephant a flannel cloth (jhool) ought to be first thrown over the back, and the ends tied together

beneath the abdomen. The hot water (without cow-dung) may be applied to the cumblie by means of a brush, as above alluded to. This will soon become saturated with hot water, and the continued application of this will keep up its temperature, which the thickness of the cloth will prevent immediately becoming reduced."

Blistering and *Firing* are not frequently resorted to. They are, as compared with the same processes on horse, ox, camel, &c., simplified by the paucity of hair. The commou BLISTERING OINTMENT is made up of ordinary Unguentum Cantharidis together with twice its bulk of turpentine.

Poulticing boots for the feet are particularly useful as a protection from injury and dirt of these important organs when they are suffering from disease.

We have already dealt with the METHODS OF RESTRAINT adopted during operations. Sometimes these provo quite unnecessary but generally they are required for the safety of the Surgeon and his Assistants. We believe chloroform has been successfully used in operations on the elephant but have no exact record of this to hand. There are very few operations in which it would be required and it is doubtful whether the elephant feels pain very acutely.

In making *Post Mortem Examinations of the elephant* the greatest care must be exercised to avoid entry of the body-fluids through small wounds about the hands and arms of the operator. A recent sad case of fatality resulting from such inoculation has been brought to my notice, and para. 1792 of the 1882 Indian Commissariat Code says " attendants cutting up dead elephants should anoint their hands with sweet oil to prevent the breaking out of ulcers which are liable to be caused by contact with the fluids of the dead body." Probably the cases in which ill results have ensued were of specific disorder. The same paragraph enjoins that "when an elephant dies, after the usual *post-mortem* examination, it shall be removed to some distance from the cantonment and buried." The ordinary post mortem instruments, as supplied by Government, suffice, with exception of the saw, in place of which a long thin saw devoid of back is needed for making sections of the skull. A sharp axe will also be found useful. Each elephant establishment should have a set of these instruments available.

List of Medicines for the Elephant.

1. European Veterinary Medicines and * those procurable fairly unadulterated in most Bazaars.

Name of drug, English.	Hindustani Name.	Internal uses.	External uses.	Dose.	Authority.
* Vinegar ...	Sirka ...	Refrigerant ...	Rubifacient, Antiseptic	About ¼ pint.	
Nitric Acid ...	Shore-ka-Tezal ...	Nil ...	Caustic ...	Nil	
Carbolic Acid ...	Nil ...	Given in Anthrax ...	Wound dressing ...	About ʒij.	
Arsenic (White) ...	Sufed Sunbul ...	Tonic (Alterative) ...	Caustic ...	10-30 grs.	Gilchrist.
Tartar Emetic ...	Nil ...	Sedative ...	Stimulant ...	ʒj-ʒij.	do.
Nitrate of Silver ...	Kari Kahr ...	Nil ...	Caustic ...	Nil	
Aloes ...	Musabbar; Ilva ...	Tonic; Purgative ...	Stimulant to Wounds..	℥j.	Slymm.
Butea Seed ...	Palas-ka-bioj ...	Vermifuge ...	Nil ...	ʒiv.	
Capsicums ...	Mirch ...	Stimulant ...	do. ...	ʒij.	
Chloride of Lime ...	Nil ...	Used in Flatulence ...	Disinfectant ...	℥ss.	
* Camphor ...	Kafúr ...	Narcotic, Antispasmodic	Nil ...	ʒv-℥iij.	
Chloroform ..	Nil ...	Anæsthetic ...	do. ...	℥iij (aht).	
Chalk ...	Khari Mitti ...	Astringent ...	Desiccant ...	℥jv.	Slymm.
Sulphate of Copper ...	Nila túta ...	Tonic and Astringent..	Stimulant and Tonic...	ʒij.	
Cantharides ...	Nil ...	Nil ...	Vesicant ...	Nil	
* Catechu ...	Kát ...	Astringent ...	Astringent (Chóbing)..	ʒv-℥vj.	Gilchrist.
* Indian Hemp ...	Bhang ...	Narcotic ...	Nil ...	ʒv-ʒx.	
* Sulphate of Iron ...	Hírá Kasis ...	Tonic ...	Nil ...	ʒjjj-ʒvj.	
* Gentian ...	Pakhan-béd ...	Tonic bitter ...	Nil ...	℥ij.	Slymm.
Ginger ...	Sohnt ...	Stimulant Aromatic ...	Nil ...	℥j.	
Glycerine ...	Nil ...	Nil ...	Emollient ...	Nil	
Calomel ...	Ras Kapúr ...	Alterative; Aperient...	Caustic ...	ʒss-ʒj.	
Corrosive Sublimate...	Shavír ...	Nil ...	Corrosive ...	Nil	
Red Iodide of Mercury.	Nil ...	Nil ...	Vesicant ...	Nil	
Solution of Ammonia...	Nil ...	Stimulant ...	Nil ...	f℥ij-f℥jjj.	
* Croton seeds ...	Jépál ...	Cathartic ...	Nil ...	ʒvj-℥jss.	Gilchrist.

List of Medicines for the Elephant.—(Continued).

Name of drug, English.	Hindustani Name.	Internal uses.	External uses.	Dose.	Authority.
* Castor oil	Arandi ka-Tél	Cathartic	Nil	Oij.	Gilchrist.
Oil of Turpentine	Gandha barójé	Stimulant; Diuretic	Stimulant	℥v.	
* Opium	Afím	Narcotic; Anodyne	Anodyne	℥ss-℥j.	
* Nitre	Shórá	Diuretic; Refrigerant	Refrigerant	℥ss-℥j.	
Tar	Kíl	Nil	Useful for foot sores	Nil	
Mustard	Rai	Nil	Stimulant	Nil	
Nitrous Ether	Nil	Diffusible Stimulant	Nil	f℥jv.	
* Nux Vomica beans	Kuchlá	Nerve Tonic	Nil	ʒss-ʒij.	Gilchrist.
* Salt. Common	Nímak	Tonic; Vermifuge; Nutrient	Nil	one pound.	
* Sulphur	Gandhak	Alterative	Used in skin affections	ʒjv-℥ij.	
* Soap (Country)	Sabún	Anthelmintic	Detergent	ʒj-ʒvj.	
* Assafœtida	Hing	Stimulant; Antispasmodic; Vermifuge	Nil	ʒjv-℥ij.	
Aconite	Atis; Butchnagh	Sedative	Nil	Doubtful.	
* Myrrh	Ból	Stimulant Tonic	Traumatic	ʒij-℥j.	
Turpentine	Gandha barójé	Diuretic	Stimulant	ʒij-℥j.	
Zinc sulphate	Sufed tútá	Tonic	Astringent	ʒij-ʒjv.	
* Wax	Móm	Nil	Adhesive	Nil	
* Verdigris	Zangár	Nil	Stimulant to wounds	Nil	
* Resin	Dhuna	Diuretic	Adhesive	℥j-℥jv.	
Gum Acacia	Babul	Demulcent	Nil	*Ad lib.*	
Hog's Lard	Churbí	Nil	Vehicle	Nil	
* Alum	Phitkurí	Astringent	Astringent	Nil	
* Chloride of Ammonia	Mousádar	Liver Stimulant	Refrigerant	℥j-℥jjj.	
Oak Galls	Mazu phal	Astringent	Astringent	ʒj-℥j.	Gilchrist.
* Linseed	Alsí or Tísí	Demulcent	do.	*Ad lib.*	
Borax	Sohága	Nil	Mild Stimulant	Nil	

List of Medicines for the Elephant—(Continued).

2. Some of the most useful Medicines not yet mentioned—All procurable in Bazaar.

Name and nature of Drug.	Hindustaní Name.	Action Internally.	Uses Externally.	Dose.
Mudar root and flowers ...	Aak ka jur aur phul ...	Narcotic ...	Vesicant ...	About ʒiij.
Tender ink-nuts ...	Kákar Singi ...	Tonic and Astringent ...	Astringent ...	ʒjv.
Marking nut ...	Bhélá ...	Stimulant ...	Caustic ...	ʒjv.-℥j.
,, ,, (Tonic bitter root)	Biscoprah ...	Tonic ...	Nil ...	ʒjv.-℥j.
Sweet flag ...	Butch ...	Tonic and Stimulant ...	Nil ...	ʒjv.-℥j.
Chíretta ...	Charáyatah ...	Tonic ...	Nil ...	ʒj.-℥iij.
Cocoanut oil ...	Coprai ka tél ...	Demulcent ...	Emollient ...	*Ad lib.*
Arrack ...	Dárú ...	Stimulant; Antispasmodic	Nil ...	Oj.-Oij.
Thorn apple ...	Dhaturay ...	Narcotic ...	Nil ...	ʒjv.-. vj.
Cubebs ...	Kabáb chini ...	Aromatic; Stimulant ...	Nil ...	ʒjv.-℥j.
Coriander ...	Dhanyá ...	do. ...	Nil ...	ʒjv.-℥j.
Cardamoms ...	Iláchí ...	do. ...	Nil ...	ʒjv.-℥j.
Wheat flour ...	Geong ka átá ...	Vehicle ...	Nil ...	*Ad lib.*
Melted butter ...	Ghee ...	Vehicle and Demulcent...	Vehicle ...	lbs. ij.
Coarse sugar ...	Jagury ...	Vehicle ...	Nil ...	*Ad lib.*
Bonduc nut ...	Kat Karanj ...	Stimulant Tonic ...	Discutient ...	ʒiv.-℥j.
Gum Benjamin or Bezoin ...	Lóbán ...	Stimulant Antispasmodic	Nil ...	ʒiv.-℥j.
——	Ujwan ...	Stimulant Aromatic ...	Nil ...	ʒiv.-℥j.
Bdellium ...	Googul ...	do. ...	Nil ...	ʒjv.-℥j.
Antidysenterica, "Wild oat"...	Inderjou ...	Stimulant Carminative...	Nil ...	ʒjv.-℥j.
Black pepper ...	Kálá Mirchí ...	do. ...	Nil ...	ʒjv.-℥j.
——	Kútki ...	A valuable Tonic ...	Nil ...	ʒjv.-℥j.
Hyoscyamus ...	Korasani Ujwan ...	Narcotic ...	Nil ...	ʒj.-ʒij.
Caraway seeds (Indian) ...	Omam ...	Stimulant ...	Nil ...	ʒjv.-℥j.
——	Malkagini ...	Excitant and Tonic ...	Nil ...	℥vj.
——	Dikmálí ...	Antispasmodic ...	To keep away flies ...	ʒjv.-℥j.

List of Medicines for the Elephant—(Continued).

Name and nature of Drug.	Hindustaní Name.	Action Internally.	Uses Externally.	Doses.
Jingili oil ...	Mitá Tél ...	{ Vehicle ...	Vehicle, Emollient ...	Oj.-Oij.
		{ Laxative ...	Demulcent ...	
Lamp oil ...	Arand ka tél ...	Nil ...	Stimulant ...	Nil.
Black oil ...	Malkagini ka tél ...	Stimulant and Excitant..	Nil ...	Nil.
Country Liquorice root ...	Gungehí ...	Nutrient ...	Suppurant and Detergent	Nil.
Soap nuts ...	Rítá ...	Refrigent; Purgative ...	Detergent ...	lbs.j.-ij.
Margosa tree ...	Ním ...	{ *Bark*-Tonic ...	Nil ...	ʒjv—℥j.
		{ *Leaves*-nil ...	Stimulant ...	Nil.
Papaw tree ...	Popaiya ...	Nil ...	*Sap*-Digestive ...	Nil.
Tamarind pulp ...	Amblí ...	Laxative ...	Nil ...	℥vj.
Cassia pulp ...	Amaltás ...	do. ...	Nil ...	℥vj.

It is necessary to insert a few simple prescriptions, of ascertained value and such as may be safely resorted to, in this work. Lest the critical reader object to this as encouraging empiricism and irregular treatment of cases, I must remind him that treatment of the diseases of elephants is generally in the hands of the non-veterinarian, who must be instructed as to prescriptions which will most probably do good or he will desperately resort to some almost certain to do harm. It is surely better, for instance, that a stimulant tonic be given in Zérbád than one of the drastic mercurial mussauls so fatal in the hands of the Mahouts! I have a further plea in extenuation, the infancy of elephant therapeutics, I have already shown that we labour under the difficulty of not knowing the doses for the elephant of most drugs, nor even (with accuracy) the effect they produce. These arguments will explain the *raison d'etre* of the following.

FORMULARIUM OR DISPENSATORY.

I. TONIC MUSSAULS (for such diseases as Zérbád and Asthenia).

1. Take of

Ingredient	Quantity	Directions
Gentian ...	each 1 ounce	Reduce to powder and mix with sufficient honey to make a bolus. (Slymm).
Bonduc nut.		
Sweet flag..	each ½ ,,	
Ujwan ...		
Ginger ...		
Arsenic (White),	5 grains	

2. Take of

Ingredient	Quantity	Directions
Bonduc nut.	each ½ ounce	Infuse in about two pints of boiling water for half an hour, strain it well and then add the Jaggery and Arrack. (Slymm).
Sweet flag ..		
Long pepper		
Cummin seed		
Chiretta ...	1 ,,	
Jaggery ...	2 ,,	
Arrack ...	3 ,,	

3. Take of

Ingredient	Quantity	Directions
Chiretta, powdered	2 ounces	Mix with water, a pint and a half, and give daily.
Black pepper ...	1 ,,	
Arrack	½ pint	

4. Take of

Ingredient	Quantity	Directions
Malkagini ..	4 ounces	Mix and give as a Bolus.
Kootkee	1 ,,	
Ginger	1 ,,	
Honey (sufficient)		

II. STIMULANT MUSSAULS (To be given in cases of collapse and depression).

1. Take of

Ingredient	Quantity	Directions
Spirits of Turpentine	5 ounces	Mix and give as a drink.
Nitrous Ether ..	2 ,,	
Sweet (Jingili) oil..	1 pint	

2. Take of

Ingredient	Quantity	Directions
Gum Assafœtida...	1 ounce	Mix and give as a bolus.
Ginger	½ ,,	
Bonduc nut ...	½ ,,	
Honey and Jaggery, sufficient.		

III. Antispasmodic Anodyne Mussauls (for Colic, &c.).

1. Take of Opium ...		each 5 drachms.—Mix with nine ounces of Jaggery. Repeat in an hour if necesary. (Gilchrist).
Assafœtida..		
Ginger ..		

---

2. Take of Ginger ...	... 4 ounces	Mix with sufficient Jaggery; for cases of flatulence. (Gilchrist). (Omit the Antimony compound).
Assafœtida	... 1 ,,	
Sweet flag	... 2 ,,	
Margosa bark	... 8 ,,	
(Antimony Sulphuret	2 drachms.)	

IV. Sedative Mussaul.

Take of Tartar Emetic.	each 2 drachms	Mix—make into a bolus.
Aconite ...		
Wheat flour ...	each sufficient	
Ghee ...		

V. Diuretic Dose.

Take of Nitre... ...	... 1 ounce	Mix with honey and give as a bolus.
Turpentine ...	... ½ ,,	
Resin ...	... 1 ,,	
Country Liquorice root.	3 ,,	

VI. Cathartic Mussauls.

1. Take of Aloes ...	... 1½ ounce	Make into a bolus. (Slymm).
Coriander...	... 1 ,,	
Jaggery ...	... enough	

---

2. Take of Aloes ...	4 drachms	Reduce to powder & give with Jaggery as a bolus. (Gilchrist).
Croton seeds	2 ,,	

---

3. Take of Tamarind...	... 2 ounces	Put the whole into a tender plantain leaf and give.
Salt ...	... 8 ,,	
Cassia pulp	... 1 ,,	
Sweet oil ...	... 8 ,,	
Cummin ...	... 1 ,,	

4. Take of Croton seeds 1 ounce
Calomel ... 1½ drachms
Aloes ... 6 ,,
Rice flour or Gur as much as necessary.
} Mix and make into a ball. (Forsyth).

VII. Astringent Mussaul.

1. Take of Opium ... 1 ounce
Catechu ... 2½ ounces
Chalk ... 5 ,,
Jaggery ... 10 ,,
} Divide into four. Give one dose every 4 hours. (Hawkes).

(For *Lungun*).

2. Take of Inderjou ... } each ½ ounce
Bdellium ... }
Catechu ... ... 1 ,,
Common salt ... 5 ,,
Water ... ... 1½ pint
} Mix and give as a draught.

VIII. Miscellaneous.

(For Musthee) Ghee ... 4 lbs.
Wheat flour.. 8 ,,
Onions ... 8 ,,
Sugar ... 8 ,,
} Make into boli and give one night and morning till the whole have been taken (Hawkes).

IX. External Applications. These do not differ materially from those resorted to in other branches of veterinary practice. The following recipes are useful :—

1. *Camphorated Oil.* (Gilchrist).
Take of Jingili Oil ... 1 pint
Camphor ... 3 ounces
} Mix and dissolve.
(To prevent flies attacking wounds).

---

2. *Dikkamalay Ointment.* (Hawkes).
Take of Resin of Gardenia lucida (Dikkamalay) ...
Bees wax ...
} of each 5 tolas (say 2 oz.)

Jingili oil ... ... 6 tolas (say 2 oz.)
Pulverised gall nuts ... 2 tolas (say ½ oz.)

Boil the powdered gall nut in the oil, then add the Dikkamalay, and when it is melted strain through a cloth; lastly add the wax and stir till cold.

---

3. *Ointment for tender feet* (Hawkes). "Chóbing."

Take of Aloes ...
Wax ...
Dammer..
Grease ...
(of each 1 part)
Catechu... ... 4 pts.

Melt together and apply as an ointment.

---

4. *Blistering ointment.*

Take of Common Cartharides ointment (1–6), one part.
Venice Turpentine ... two parts.

Heat together, with stirring, until they are thoroughly mixed.

APPENDIX.

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II. The following Translation of a passage from Book VIII of ARISTOTLE's *Historia Animalium* is here inserted as one of the earliest notices of Diseases of Elephants, probably the first in occidental literature :—

Elephants are said to be free from other maladies but to be troubled with flatulency * * * *. Elephants suffer from flatulent disorders, whence it happens that they can neither expel the moist excrement or urine nor that of the belly; and if they have eaten earth, they become diseased, unless they have been constantly in the habit of doing this, in which case they are not injured. Sometimes also they devour stones and are attacked with Diarrhœa, of which they are cured by warm water being given them to drink, with hay to eat steeped in honey; both of these remedies arrest the disease. When they are wearied from want of repose, a cure is effected by rubbing the shoulders with oil and warm water, but if the shoulders are in pain roasted pig's flesh is applied with relief. Some elephants do not drink oil, but others do, and such it is said have the power of ejecting any iron-weapon that has been plunged into the body; but to those who do not drink it they give roots cooked with oil."

III: MADRAS ACT No. I OF 1872

An Act to prevent the indiscriminate destruction of wild elephants.

Whereas it is expedient to make provision to prevent the indiscriminate destruction of wild elephants within the Presidency of Madras; it is hereby enacted as follows :—

1. This Act extends to the Territories for the time being subject to the Government of the Presidency of Fort St. George; and it shall come into force on the first day of October 1873.

2. From and after the said day, the destruction of wild elephants is prohibited, except as hereinafter provided.

3. Whoever shoots at, or intentionally destroys, or abets, within the meaning of the Indian Penal Code, the shooting at, or destruction of, any wild female elephant upon waste or forest land, whether such land be the property of Government, or otherwise, shall be liable to a penalty not exceeding five hundred Rupees, and, in default of payment, to simple or rigorous imprisonment for a period not exceeding three months.

Any person convicted under this Act of an offence committed

after his previous conviction under this Act, shall be liable to a penalty not exceeding one thousand Rupees, and, in default of payment, to simple or rigorous imprisonment for a period not exceeding six months.

4. Whoever, not being authorized thereto by a license granted under the provisions of Section 7, shoots at, or intentionally destroys, or abets, within the meaning of the Indian Penal Code, the shooting at, or destruction of, any wild male elephant upon waste or forest land, the property of the Government, shall, upon a first or second conviction, be liable to the penalties and periods of imprisonment respectively provided for a first or second conviction in Section 3 of this Act.

5. Nothing in this Act shall be deemed to prevent any Zemindar or other proprietor or occupier of land, or any person duly authorized in that behalf by any such Zemindar, proprietor, or occupier, from destroying wild male elephants upon the waste or forest lands of such Zemindar, proprietor, or occupier.

6. Nothing in this Act shall be deemed to prevent any person from shooting at, or destroying any wild male or female elephant found upon cultivated lands, or upon or in the immediate vicinity of any public road, or to prevent any person from shooting at, or destroying any male or female elephant in defence of himself or any other person.

7. The collector or other officer in charge of a district may, subject to such rules as may, from time to time, be made by the Local Government, issue a license to any person authorizing him by name to shoot wild male elephants upon waste or forest lands, the property of the Government, in such district, for the period of one year from the date of the grant of such license. Every such license shall become void at the expiration of the said period, but may be renewed by such Collector or other officer for a like period.

Provided that every such license shall become void upon the conviction under this Act of the person to whom such license was granted.

8. The Local Government may make rules for regulating the grant or renewal of licenses under this Act, and the fees to be charged on such grant or renewal, and may, from time to time, alter or cancel such rules.

9. Every prosecution under this Act shall be commenced within a period of six months from the date of the offence in respect of which it is instituted.

IV. ON THE INTERNAL TEMPERATURE OF THE ELEPHANT (from No. 116, Vol. XX of the *Veterinary Journal*).

Preliminaries and Detail. These animals are very nervous at the operation, require to be judiciously handled or they will rise from the kneeling posture which they should be made assume and impede the operation by passage of urine and fæces. There is a lot of loose skin around the anus, so the Thermometer has to be passed in very deeply. The tail is powerful, requires two men to hold it, and then is apt to press on the hand at the anus very forcibly.

Results.—My researches so far lead me to believe that the normal internal temperature at the rectum is 97·6°F.—a reading equal to the normal of the horse, therefore, shows high fever.

(J. H. Steel.)

V: APPENDIX XXXIV. OF REVISED TRANSPORT REGULATIONS.

Revised Rules for the Embarkation of Elephants In Railway Trains, framed by Lieutenant-Colonel Kinloch, Officiating Assistant Quarter Master General, Presidency District,—dated Fort William, 19th May, 1881.

The first precaution to be taken is to avoid all noise, or anything that may frighten or excite the elephants. For this reason they should, when practicable, be embarked in a quiet shed, where no one should be allowed to enter except the elephants' attendants and such a number of workmen as may be necessary for arranging the fittings and closing the carriages.

The men thus employed should be previously carefully instructed as to what they have to do, and should be warned to work expeditiously and silently.

Elephants being gregarious animals and frequently apt to be uneasy when alone, three or four together should be taken into the loading shed; more are not desirable, as there would be additional risk of noise and confusion. As some elephants are too timid to enter a truck or other strange place without coercion, two or three staunch and powerful tuskers should, when practicable, be kept in readiness to force unwilling elephants into the

trucks. This expedient, however, should only be resorted to as a last resource; it will seldom be necessary.

The trucks selected should be very carefully inspected, and it should be particularly ascertained that the floors are strong, and fittings complete and in perfect working order.

As some elephants are shy of trusting their weight on any yielding surface, it is well to put wedges under the springs of the trucks, so that the animals may find a firm platform to tread on.

In order that the elephants may be secured as quickly as possible after entering the trucks, they should be fitted with fetters, and chained beforehand as follows:—

I. The two fore and hind legs should be coupled together with strong fetters ("berries") so closely connected as just to allow the animal to shuffle along by short steps.

II. The front and hind coupling chains should be connected by a chain so adjusted as to be about six inches longer than the space between the elephant's fore and hind legs when standing in a natural position.

III. Chains terminating in bent hooks should be attached to the connecting rings of each pair of "berries." These are for the purpose of securing the elephant to the ring-bolts outside each end of the truck. The front chain should be handed to the mahout on the elephant's neck and hauled up clear of the ground, so as not to be trodden on. The rear chain may be allowed to drag.

IV. A strong chain collar covered with leather, and furnished with a chain long enough to be secured to a ring-bolt in the floor of the truck, should be fitted to each elephant.

V. Strong ring-bolts are fixed in the floor of the truck, one just in front of, and one just behind, the elephant. The fore and aft chains (No. III) are passed through these ring-bolts before being secured to the end ring-bolts above referred to.*

The neck chain is also hooked to the front ring-bolt.

The "berries" or coupling chains, and the connecting chains, are fastened by the well-known device of "pinched links": the three chains by which the elephant is secured to the truck ter-

*There would be considerable risk in using inferior or badly fitted tackle: special fetters of approved pattern have been constructed by Messrs. Jessop & Co. of Calcutta, and are stored in Fort William Arsenal.

minate in long bent hooks, and the links of these chains are made so large as to admit of the hooks being inserted in them; and the chain may thus be rove through a ring and adjusted to any required length.

The chains should, if possible, be fitted to each animal before he is brought to the loading platform * * * * * *

VI. The bridge from the platform to the truck should be strong and firm and as nearly level as possible. Both it and the floor of the truck should be covered with short grass or straw.

VII. The doors of the truck having been thrown wide open, the side beams on the side of entry having been removed, and the rear beam having been adjusted according to the length of the elephant, the mahout will ride the first selected elephant (which should be one of the quietest and boldest) into the truck, another attendant going in front with a bundle of sugarcane or other attractive food. If a portion of the carriage is roofed in (which does not appear to be necessary now that the elephant's head is secured,) the mahout should either sit on its back from the first, or slip back from the neck, as the elephant enters the truck.

VIII. The moment it is fairly in its place, the collar chain should be hooked to the ring-bolt in the floor, and the side beams expeditiously but silently run into their places and firmly bolted down to the cross pieces by men who have been standing ready for the purpose. The most convenient and quickest method of placing these long beams in their places is by hauling them through by ropes attached to rings or staples in their ends.

IX. The front chain hitherto held up by the mahout should be dropped as soon as the neck chain is secured, passed through the ring-bolt in floor, and then through the opening at end of truck; where, after being hauled taut, it should be hooked.

The rear chain should similarly be passed through the ring-bolt, behind the elephant, and secured to the other end of the truck. In case of an elephant proving troublesome, a man with a long hook should be stationed at each end of the truck, so as to be ready to catch hold of the chains and draw them within reach.

X. If the above is properly done, the animal should be immovably secured in a few seconds, during which time his attendants should have been diverting his attention by feeding and carressing him.

XI. The mahouts should always travel in the truck with their elephants and should re-assure them by their voices and give them favourite food; but they should not go where the elephant could accidentally injure them if frightened.

XII. When three or four elephants have been embarked, the trucks should be quietly run out of the loading shed by hand; and another batch of elephants brought in, and so on.

XIII. Care should be taken to alarm the elephants as little as possible at first, and the train should be quietly and carefully started, without unnecessary whistling or other noise.

XIV. On the journey elephants should have abundance of some forage which they like, and they should be frequently supplied with water at halts. They should also have water poured over them. To enable the animals to drink, care should be taken not to place the rear bar too close, nor to shorten the collar chain too much, or the elephant will be unable to raise its head sufficiently.

XV. Before elephants have to travel by rail, it would appear to be a safe precaution to starve them for a few hours, as animals distend with food would probably be more liable to rupture or other internal injury, should they struggle much.

XVI. When disembarking, the same precautions should be taken as when embarking, all fastenings being removed in reverse order to that in which they were secured.

VI. V. S. (1st Cl.) R. Frost has experimented as to the effects of "*Anthrax vaccination*" according to Pasteur's method on Forest Department elephants in British Burma. His results are encouraging but not conclusive.

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